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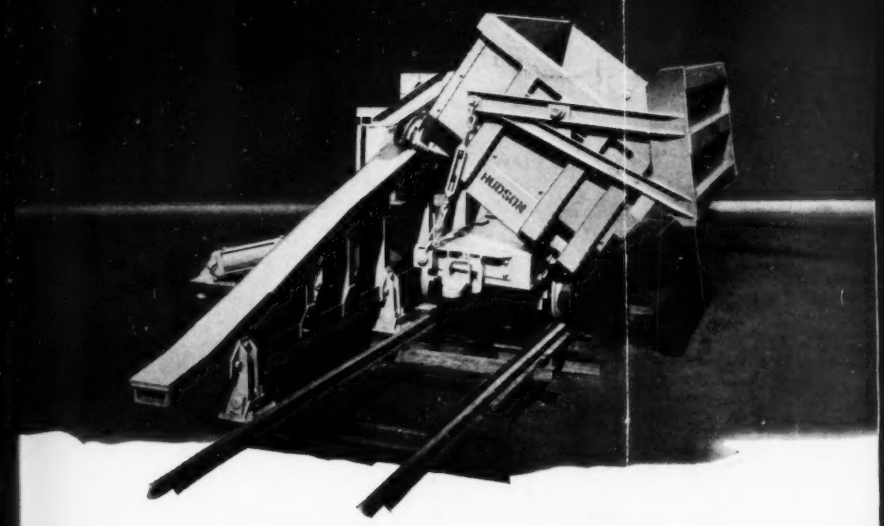

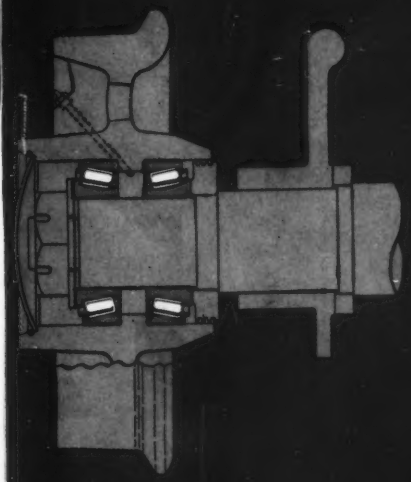

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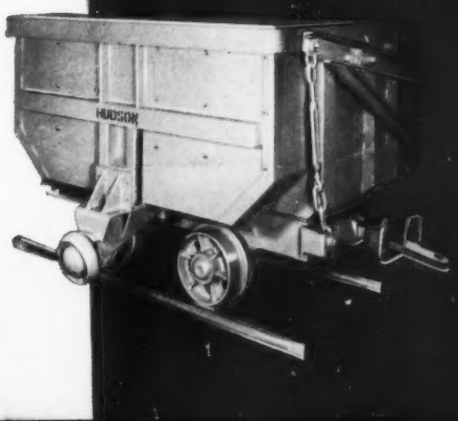

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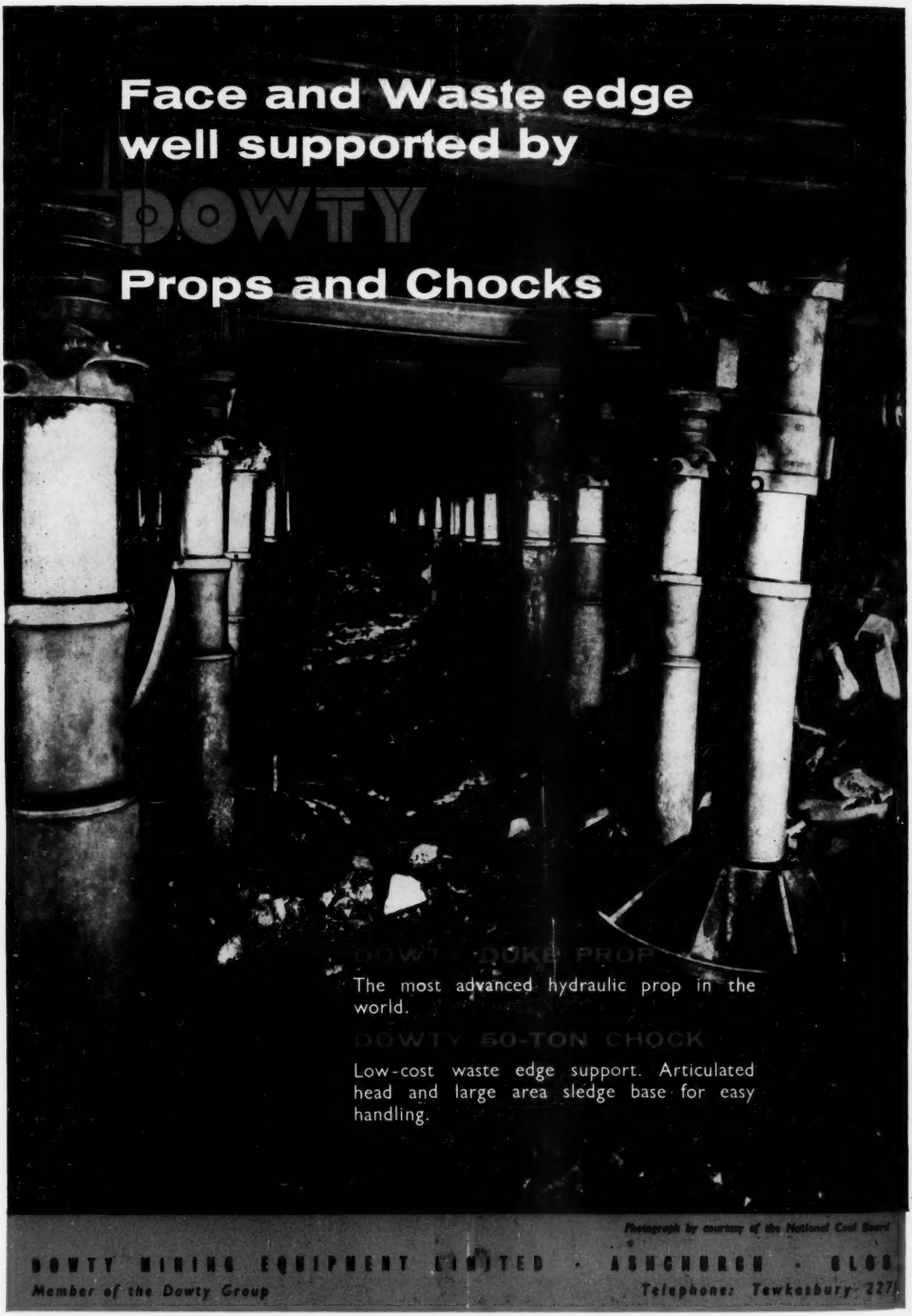
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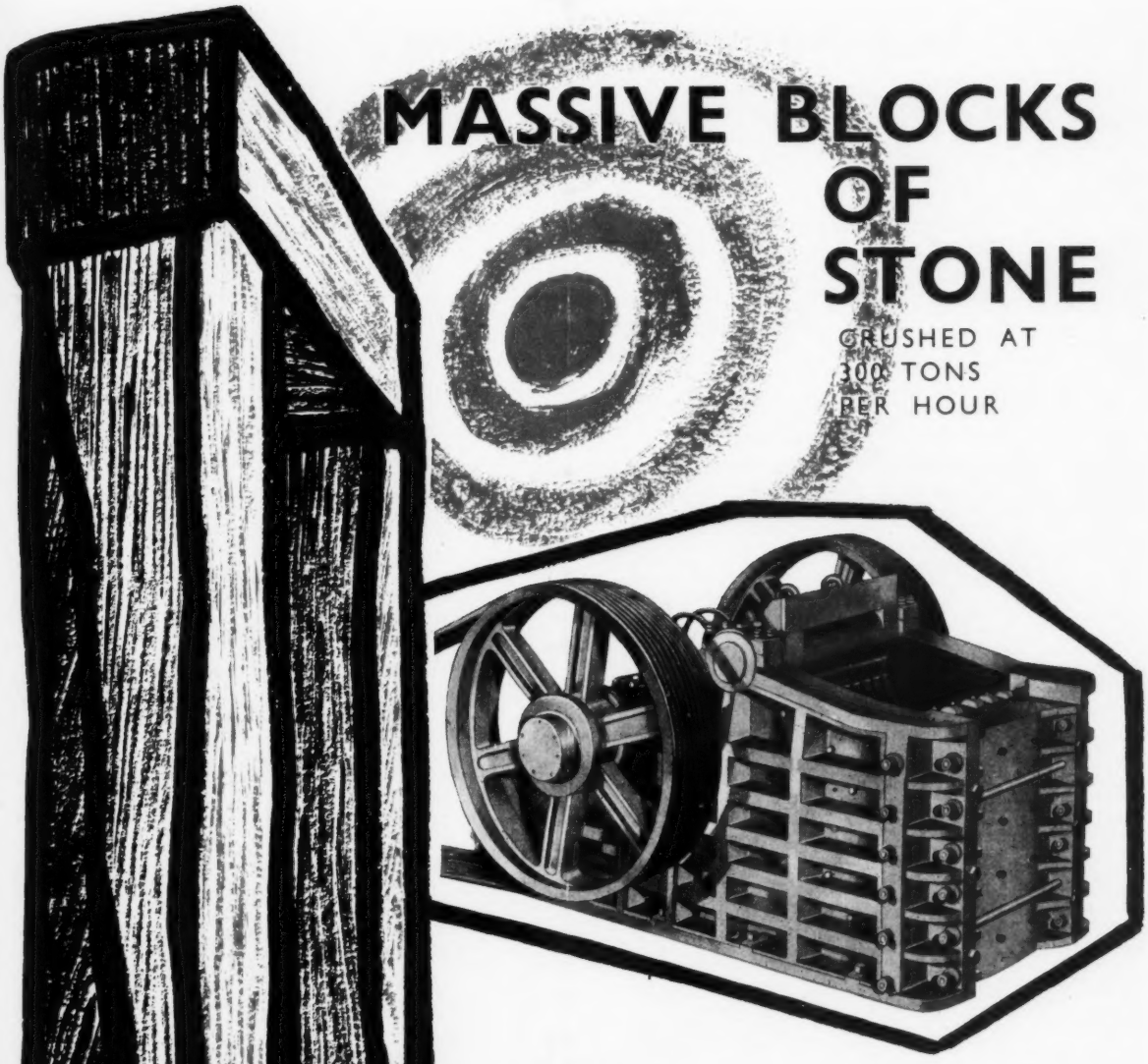

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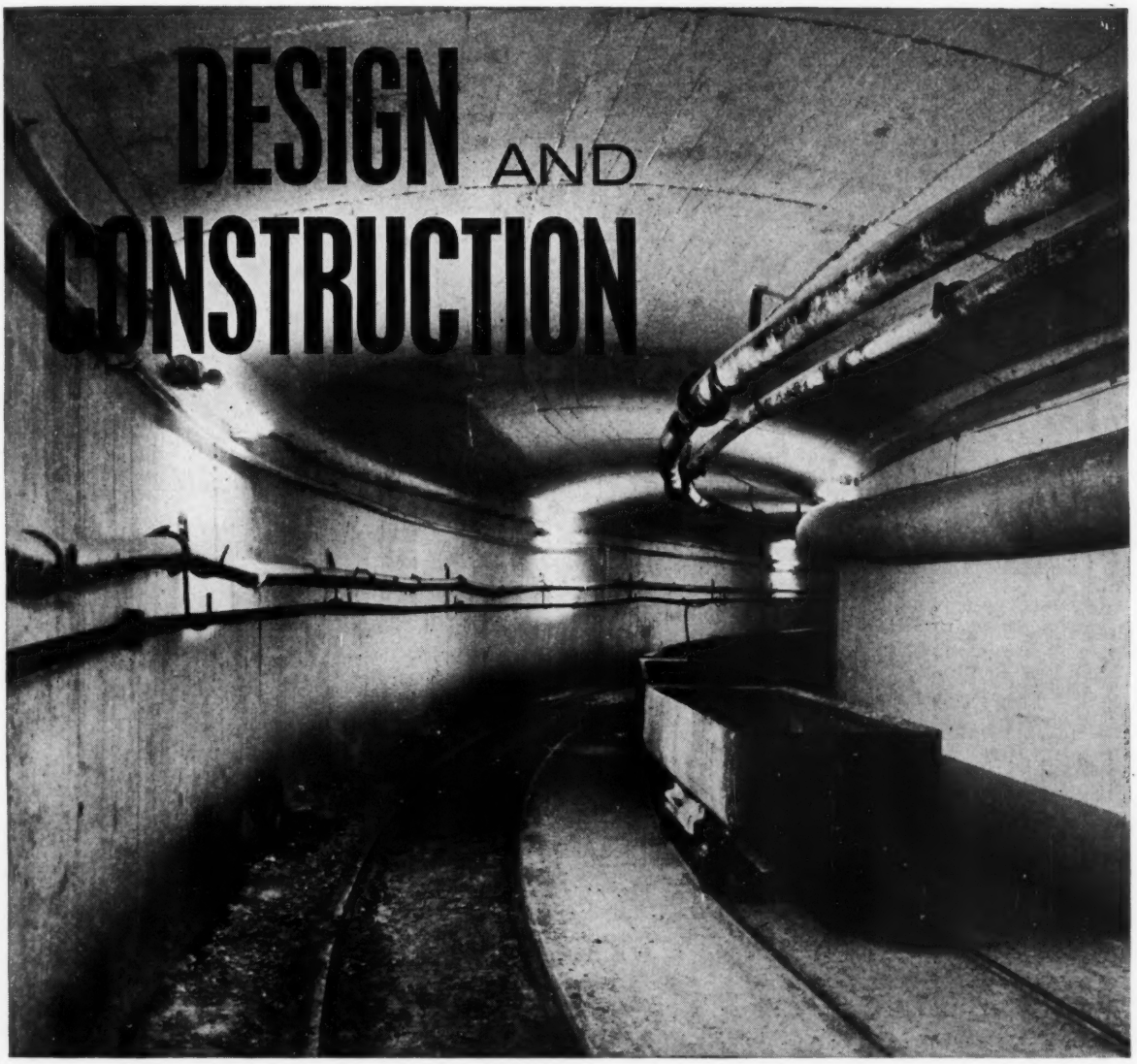

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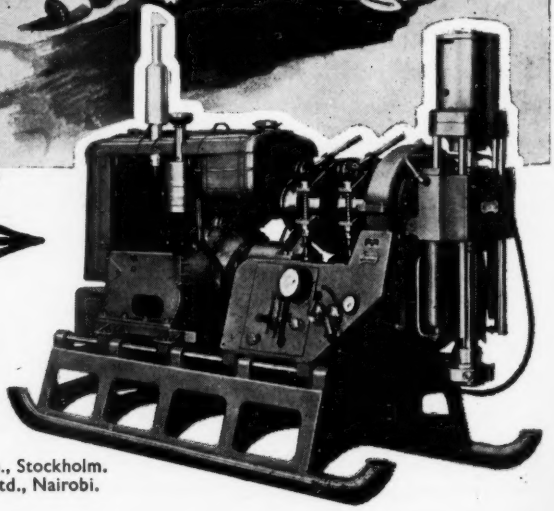

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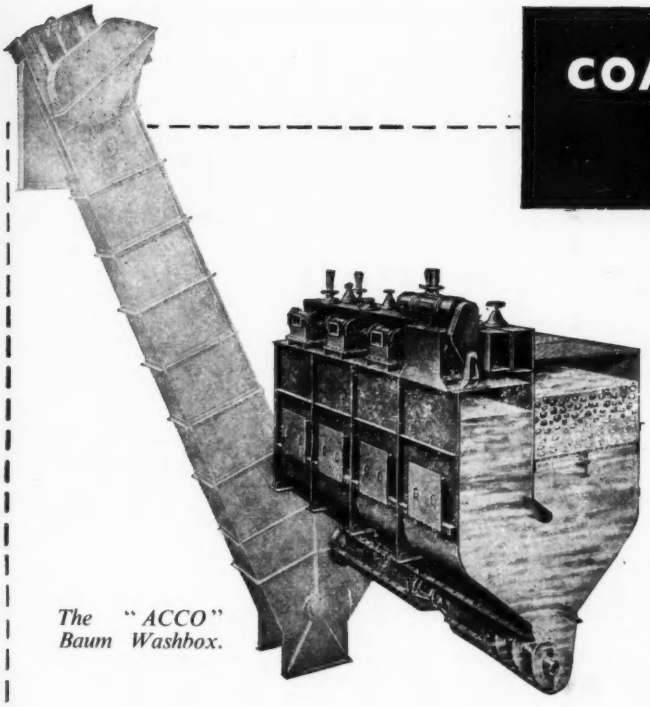

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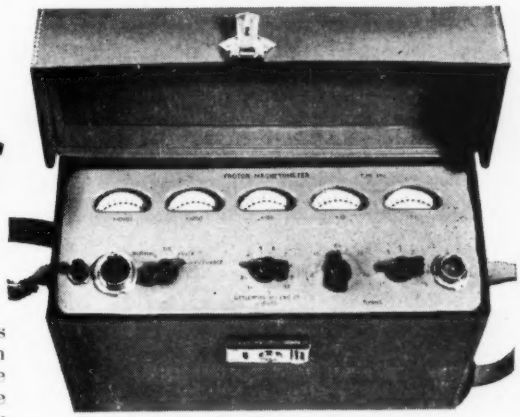

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The Mining Journal

London, October 21, 1960

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Editor
U. Baliol Scott
Deputy Editor
A. Graham Thomson
Assistant Editor
R. Bowran

Display Advertisement Manager
E. S. Hooper
Circulation
Robert Budd

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Capital for Underdeveloped Countries

FOR political as well as economic reasons, the provision of capital for underdeveloped countries has become one of the most important issues at the present time. In the annual report for 1959 of the International Monetary Fund, presented at the Washington meeting in September, it was pointed out that the less developed countries had been hit by falling terms of trade, which have declined by 12 per cent since 1954. Because of changes in demand and supply and the introduction of synthetic substitutes there has been no appreciable general increase in primary product prices. Yet, despite these less favourable trade conditions most of the primary producing countries, far from cutting their economic coats to match the smaller cloth, are progressively raising their planning targets, confident that in one way or another the money will be found.

This confidence appears to be fully justified. As stated in the I.M.F. report, with the reconstruction of their own economies virtually completed, industrial countries are in a position to play a more active role in providing capital for developing less industrialized countries. Economically it is undoubtedly in their interest to do so in order to ensure expanding markets for their own manufactured products. At the same time, politically, economic aid, with or without strings, has become one of the most powerful weapons in the ideological struggle for the support of the uncommitted nations. One way or another, the latter will certainly get most of the money they require.

Throughout recent years, economic aid has been steadily rising. In 1959, government grants and loans by the industrialized countries of the Free World to the less-developed nations were estimated at $4,000,000,000, of which the United States supplied about two-thirds and France and the United Kingdom most of the remainder.

Apart from U.S. Government assistance totalling $2,694,000,000 (exclusive of the U.S. subscription of $1,375,000,000 to the I.M.F.) U.S. companies added $2,500,000,000 last year to their investments in foreign subsidiaries and branches, a capital outflow of $1,400,000,000 and reinvested earnings of $1,100,000,000 raising the total value of their foreign investments to $30,000,000,000.

The United Kingdom is the only net exporter of capital in the Commonwealth, to which funds are channelled from it in three ways. First, there is a good deal of private investment from the U.K. in all Commonwealth countries. Secondly, the U.K. Government has made and is making grants and loans to Commonwealth Governments. Thirdly, there are U.K. Government repayments of capital and payments of interest on special loans made to the U.K. during and after the war. Total U.K. expenditure from public funds on economic and technical assistance to overseas territories rose from £75,000,000 in 1957-58 to roughly £100,000,000 in 1958-59. Private investment by the U.K. in other countries, mostly in the Commonwealth, has been running at the rate of £300,000,000 a year gross, or £200,000,000 if allowance is made for foreign investment in this country.

The greater the flow of private investment to the underdeveloped territories, the less heavily will the overburdened taxpayer be loaded with the steadily rising cost of economic aid. That there is no lack of private funds seeking profitable employment is shown by London's enthusiastic reception of most new loans and flotations, even at a time when financial markets generally are unsettled and confused.

Private investment, however, tends to move towards the more established nations such as Canada, which offer a high degree of freedom from such political risks as disorders and interference or expropriation by the national government. On the other hand, many territories with large potential resources are unable to attract the necessary capital and technical skill because they are not regarded as offering a safe enough haven for private funds. According to *Barclays Bank Review*, recent estimates of the flow of private capital from the U.K. indicate that only one-third of total private investment is going to the underdeveloped countries, and a large proportion of this is probably investment in oil concentrated in countries such as Kuwait.

In order to attract private investors, whether individuals or large companies responsible to their shareholders, governments must be able to inspire confidence not only in their own good faith and integrity, but also in their ability to preserve law and order. There should, in addition, be favourable prospects for continued stability in the event of any change of government.

Unfortunately the number of underdeveloped territories which private investors can expect to view with any degree of confidence, far from increasing, is becoming steadily smaller. Malaya is nowadays regarded as offering a high degree of security to overseas investors. India and Pakistan, too, are attracting an increasing amount of private capital because their governments have deliberately sought to gain the confidence of the outside world. On the other hand, the upheavals in Africa have caused private investors to become increasingly chary of hazarding their money in any part of this continent, irrespective of the political situation in any particular territory.

The governments of most capital-hungry territories are ready and eager to offer foreign investors the utmost assurances that their interests will be protected and in some instances safeguards for overseas capital have even been written into the constitution. Following the recent scare in Ghana, Dr. Nkrumah reiterated the government's acceptance of the fact that foreign firms must safeguard the interests of shareholders and emphasized its readiness to accept suggestions as to how the protection of shareholders and investors could be assured.

It is evident, however, that in countries which are politically immature or insecure, or which are bordered by other nations where unstable conditions exist, guarantees given in good faith by the local government are liable to be invalidated by subsequent events. In order to discount the political hazards, investors must be protected by some system of guarantees or indemnities from sources independent of the territories concerned.

One approach to this very difficult problem envisages an internationally recognized charter laying down safeguards for foreign private capital. Such a charter was recently drawn up by Sir Hartley Shawcross, former British Attorney-General, together with a group of British lawyers, for examination by O.E.E.C. experts. Plans for a European-African conference to prepare an investment statute and a special fund providing guarantees against the risks of nationalization, local disturbances and civil wars have been submitted by the Council of Europe's Ministerial Committee to the Foreign Ministers' deputies of member countries (*vide The Mining Journal*, February 13, 1959, p. 168, and December 4, 1959, p. 567).

The United States authorities, confronted with the reluctance of private investors to take up loans for the underdeveloped countries, have also been seeking a solution to the problem. It was reported earlier this month that an offering was projected on Wall Street to help to finance iron ore development in Liberia. Should agreement be reached between the various parties and the loan be floated, buyers of the stock would be guaranteed by the I.C.A. against expropriation, war risks, and the inability of the undertaking to make its interest payments in convertible currency. If provision can be made to cover this particular case, there seems no reason in principle why the scheme should not be duplicated to fit other similar cases.

From the taxpayer's point of view there are obvious advantages in any practical scheme of insurance against political risks which could stimulate the flow of private capital to the underdeveloped countries. In those cases where undertakings financed wholly or largely by overseas capital are expropriated without fair compensation, the taxpayer would still have to carry the baby. But, generally speaking, he would merely be footing a bill which, in the form of some government loan or grant, he would have been saddled with at an earlier date if the money had not been forthcoming originally from private sources. On the other hand, he would have avoided any expenditure on a host of other projects which, by shouldering the political risks, he had encouraged private enterprise to finance.

There can be little doubt that on balance the taxpayer stands to lose very little and to gain very handsomely from such a scheme.

So, too, do the underdeveloped countries, since government grants or loans, at least as apparently still viewed in Whitehall, are merely financial contributions, whereas risk capital contributed by private investors is usually accompanied by the technical assistance and know-how which are no less urgently needed than finance. Private investors, on their part, should derive many benefits from being placed in a position to participate safely (apart from the normal commercial risks) in the development of emergent territories.

The difficulties of devising a practical system of insurance against political risks are clearly very great. On what basis should shareholders be reimbursed in the event of expropriation without fair compensation? On par value or issued price of shares? On stock exchange values at a given date? Both alternatives have obvious drawbacks.

Political interference, while falling short of expropriation, may make it impossible for a company to carry on business economically or even to carry on at all. Penal taxation, unrealistic wage levels, restrictions on the importation of technically qualified staff are but a few of the many ways in which government action could involve overseas investors in heavy losses. Then again, civil wars and disturbances could result in prolonged shutdowns and damage to plant and equipment. How far is it feasible to protect investors against these and other political risks; where should the line be drawn; in circumstances where the financial impact of government measures is not clearly defined, how are the consequential losses to be assessed? Possibly the most effective way of dealing with such problems would be to set up an international board of assessors, whose decisions would be binding.

Washington's desire to spread the aid burden has led to the emergence of such new organizations as the International Development Association and the Development Assistance Group, one of who might well be entrusted with the task of preparing and administering an international scheme of insurance against purely political risks. Meanwhile there is no reason why individual governments such as our own should not be exploring possible means of relieving their own taxpayers of some of the burden.

SPACE AGE TECHNOLOGY IN MINING

The most complete array of modern mining machinery ever assembled in the United States was seen at Las Vegas during the 1960 convention - exhibition of the American Mining Congress in October this year. One of the largest and most heavily visited exhibits was an 8,000 lb. operator's cab from a mammoth mining shovel complete with electronic controls. These controls were tied in with a unique moving picture which showed the operator's view from an identical giant shovel actually working under true strip-mining conditions.

Public and mine operators alike, it was stated at the exhibition will profit from the mining industry having adopted many of the same electronic break-throughs which made possible the sending of capsules into outer space. The speaker was Mr. Henry Harnischfeger, immediate past president of the U.S. national Power Crane and Shovel Association and also president of Harnischfeger Corp. of Milwaukee.

Mr. Harnischfeger emphasized that the mining industry was undergoing unprecedented changes, made necessary by the multiplied requirements of Free World markets and, on the debit side, diminishing ore deposits and inflationary costs. " Mining equipment has historically been big and heavy," he declared. " The machines have been largely a matter of hardware—nuts and bolts and so much steel plus enough power to rip up the overburden in sufficient quantities to get the job done. But today, these same types of machines have become precision tools made up of components which are, at least in some instances, as precision engineered as your electronic wrist watch." To illustrate this trend, it was explained that a number of models of Harnischfeger mining shovels are now controlled almost completely by electronic components and thus are actually " sophisticated units which make use of the techniques of miniaturization and controlled atmosphere often thought of only in relation to missiles and electronic brains ".

The two most important results of these electronic advancements, it was further stated, are proving to be greatly increased production capacity and less maintenance or downtime.

So, next time a sputnik is put into orbit or a capsule successfully recovered from outer space, the lessons learnt from it may contribute in due course to further advances in mining equipment and techniques.

BIG RISE IN COMMUNITY ENERGY NEEDS

Introducing Euratom's third general report to the European Parliament, President Hirsch has stressed the importance of the role of the Community in meeting the enormous increase in energy needs that was to be expected in the future. In the next twenty years primary energy requirements in the Community would go up from 460 to 800,000,000 tons of coal equivalent. Neither coal nor oil would be sufficient to satisfy this ever-increasing demand for energy, especially in view of Europe's manifest duty to help the underdeveloped countries.

" By 1980 " he said, " the Community will have to have at its disposal an installed nuclear electrical capacity of over 40,000 MW., corresponding to more than 250 units of 150 MW.".

Euratom's estimates are based on an assumed annual rate of industrial expansion in Community countries of 5 per cent in the decade 1960-1970, and of 4 per cent for the following ten years. Electricity requirements will continue to increase at a more rapid rate than total energy needs: they are forecast to be in the region of 370,000,000,000 kWh. in 1965, 700,000,000,000 kWh. in 1975, and 950,000,000,000 kWh. in 1980. By this last date *per capita* electricity consumption in the Community will be 5,000 kWh.—scarcely 10 per cent more than present U.S. consumption, and much lower than the Soviet target of 8,500 kWh. for 1980.

While in the long run large-scale atomic power will be required to meet these needs, at present a major obstacle to the development of nuclear power plants is the higher cost of electricity from this source than from conventional power stations. Manufacturers and electricity producers, says Euratom's third report, must be ready to make certain temporary sacrifices and commit themselves resolutely to carrying out a minimum nuclear programme. Only in this way will they become acquainted with the demands of nuclear technology; make the progress necessary to obtain nuclear power at a competitive price; and train the necessary qualified personnel.

In this connection, however, it is pertinent to recall Sir John Cockcroft's recent prediction that, in British conditions, nuclear stations operating on base load would generate electricity at the same cost as coal-fired stations on base load by the late 1960's, and would become increasingly competitive thereafter. Both Euratom and the U.K. Atomic Energy Authority have emphasized in recent reports that the stretch-out of nuclear power programmes implies no lack of confidence in uranium as a main future fuel source.

YUGOSLAV MINERAL OUTPUT

Over the whole of the current year, it is stated in a report issued from Belgrade, production of 87,000 tonnes of refined lead is planned for Yugoslavia, as compared with 85,395 tonnes produced over 1959. Output of raw zinc is to fall from the 1959 figure of 18,095 tonnes to 18,000 tonnes this year, while that of electrolytic zinc will be increased to 14,500 (13,659) tonnes. Production is now carried out at four minerals complexes. These are the Trepca Mines and Lead and Zinc Smelting Works, at Zvecane, for lead and zinc, the Mezice Lead Mines and Smelting Works for lead, the Cinkarna plant, at Celje, for raw and refined zinc and the Zorka Chemical Plant, at Sabac, for electrolytic zinc. In July of this year the Trepca plant recorded its highest lead exports ever, totalling 6,000 tonnes over the month.

Figures issued of monthly average production levels for the first half of 1960 show, however, that refined lead production was down slightly on the corresponding period of last year, the average month's output being one of 6,595 tonnes as compared with one of 6,642 tonnes for the 1959 half-year. Less blister copper was also produced, the average standing at 2,944 (3,186) tonnes. Against this, figures of 2,862 (2,597) tonnes of electrolytic copper, 1,963 (1,823) tonnes of aluminium, 41 (38) tonnes of mercury and 3,992 (3,541) tonnes of ferro-alloys were recorded for the monthly mean over the first 1960 half.

Full figures of bauxite exports for 1959 have been issued for Yugoslavia and show that of 815,000 (1958 : 733,000) tonnes produced, some 601,500 (1958 : 592,400) tonnes were exported. Of these total exports as much as 390,600 (404,200) tonnes went to the main customer, Federal Germany. The second largest customer, Italy, held its position but also bought less than in 1958 (175,900 tonnes as against 181,000 tonnes).

This year Yugoslav bauxite exports are expected to break all records.

CANADIAN ROUND-UP

THE first publicly financed uranium producer in the vast reaches of the Lake Athabaska area of northern Saskatchewan, is now free of debt, writes our Canadian Correspondent.

Discovered in the heyday of Canada's explosive uranium boom, Gunnar Mines Ltd. this month retired the balance owing on its original $19,500,000 funded debt. This still left the Gilbert A. LaBine directed corporation with a current asset breakup value equal to $5.60 per share and a guaranteed productive life on remaining government contracts to the end of 1963.

Although still in the rumoured category, it is beginning to appear as though Gunnar will absorb its associated company, Nesbitt LaBine Uranium Mines Ltd. This procedure would permit Gunnar to use the latter company's write-offs against future Gunnar income as a tax charge.

Nesbitt LaBine was born prior to the Gunnar discovery. The company conducted extensive underground development in the Beaverlodge Lake area of northern Saskatchewan. Work was eventually suspended when ore results failed to warrant production. As a result, substantial sums had been charged to preproduction expenses and these write-offs would prove of major tax advantages to Gunnar, now that the company is in the tax-paying ranks.

Gunnar Mines is currently operating a 2,000 ton per day concentrator and is now servicing three government uranium contracts. Excessive production is being stockpiled and will be sold later if, and when, a market develops.

Besides working on its original contract totalling $76,950,000, Gunnar Mines is also filling the uncompleted portions of contracts purchased from Canadian Dyno Mines Ltd. and Rayrock Mines Ltd. Collectively these three contracts will have permitted Gunnar to produce $141,000,000 in uranium precipitates by termination of the agreements.

At the moment, unless other markets develop, prior to termination of government contracts, the future productivity of the Gunnar Mine on Lake Athabaska appears a bit obscure. In the meantime the company is following an aggressive exploration programme throughout Canada in an effort to locate a major mineral deposit. Several propositions are now under consideration, including a couple of gold properties that are being given careful assessment.

Absorptions and Mergers

Absorption, amalgamation or consolidation of mining companies is proving rather popular in Canadian mining circles this year. This is a new wrinkle, saving productive companies considerable money and giving shareholders of inactive companies a new lease on life.

Recently Giant Yellowknife Gold Mines Ltd., a long-time rich gold producer in the North-west Territories, completed a marriage with Consolidated Sudbury Basin Mines Ltd. Giant is now using Consolidated Sudbury's preproduction expenses as a straight charge against its own income.

New Dickenson Mines Ltd., a gold producer in the Red Lake district of Ontario, has merged with Lake Cinch Mines Ltd. The latter, a subsidiary of ViolaMac Mines Ltd. shipped ore from its workings in the Beaverlodge Lake area to a custom smelter there. The uncompleted portion of its contract was sold to Eldorado for large cash proceeds.

New Dickenson, in acquiring control of ViolaMac also secured its various underlying units, including Lake Cinch. Thus by merging Lake Cinch the New Dickenson picked up about $3,500,000 cash together with Cinch preproduction expenses which will be used as a charge against its own gold operations at Red Lake.

East Sullivan Mines, a profitable copper producer in north-western Quebec, is currently asking shareholders to sell out to Quebec Copper Corp. Ltd., a former base metal producer it controlled in the eastern townships of Quebec.

This arrangement will result in a new company gaining the benefits of the old preproduction expenses of Quebec Copper as a write-off against the East Sullivan orebody.

Another Mattagami Discovery

The Mattagami district of north-western Quebec is humming on reports of another copper-zinc discovery in this comparatively newly-found mineralized belt of Canada.

This is the area that blossomed to life when the Mattagami Syndicate established a base metal orebody of major proportions at Watson Lake, about four years ago. Now financed by Noranda Mines, McIntyre Porcupine Mines Ltd. and Canadian Exploration Ltd. the Mattagami Lake orebody is being opened underground as plans are being formulated to erect a mill on the property. Initial capacity will likely be 2,000 tons daily. The Mattagami area was further activated by drill hole discoveries made by Orchan Mines Ltd. and New Hosco Mines Ltd., at locations nearby.

The current Mattagami interest centres some miles away in Joutel township, some 60 miles north of Amos, Que. This time the find was made by British capital backing Camp Bird Mines Ltd. Associates in the discovery include Prospectors' Airways Ltd. and Kerr-Addison Gold Mines Ltd., part and parcel of the $100,000,000 Noranda Mines' family.

The British and Canadian partners are still rather reticent to discuss the importance of the discovery, even though the property continues under the test of two diamond drilling rigs.

However, rumours of discovery have been sufficient to whirl shares of Prospectors' Airways, on the Toronto Stock Exchange, from 70 cents to a new high of $1.70 per share in the matter of a few days. Excitement later tempered, as it appeared a new company would be formed by the partners to finance a more aggressive programme on the discovery.

It is believed in Toronto mining circles that the British-Canadian team located two parallel zones in current drilling. Prospectors had optioned the ground from Camp Bird and Kerr-Addison partnered them in the deal.

The first zone is reported to contain high zinc and low copper together with associated minerals. Current drilling is obviously of more importance and suggests a much higher grade copper content. The initial hole in the parallel zone, is rumoured to contain one section averaging 3.45 per cent copper, plus zinc and other metals, across a 100 ft. width. Several additional holes have been completed but results have not been publicized to date.

Needless to say, news of the Prospectors' strike has fostered a new staking spree in view of most ground being open for staking to the north of the discovery. Additional acreage is being staked at other locations. It is safe to say there will be renewed activity throughout the far reaches of the Mattagami district this winter since heavy overburden requires drilling as muskeg and lakes freeze over.

Pushbutton Friction Hoist at Seafield Colliery, Scotland

A number of multi-rope, friction-drive mine hoists have recently been delivered by Asea to the National Coal Board of Great Britain. This article describes the mine hoist installed at the Seafield Colliery, East Fife, Scotland, which is probably the first pushbutton-operated friction hoist in the world working with induction-motor drive and dynamic braking. The article, condensed from "Asea Journal," No. 3, Vol. 33, was written by Arne Mark, of the Industrial Engineering Department, Mining and Industrial Transport Section

A CONSIDERABLE number of automatic and pushbutton-operated ore and service mine hoists have been delivered by Asea over the last few years with three-phase induction motors. The speed is then regulated by the service brake in combination with re-connection in steps of the secondary resistor of the motor. In the case of a skip hoist which raises a fairly constant load, such a regulating system can be adopted also for hoists having large motor outputs, provided that the load is sufficient to retard the hoist within the stipulated time when the motor torque is decreased due to the connection of the secondary resistor. The service brake need only intervene after the hoist has been slowed down to a low speed so as to make any corrections should the speed of the hoist deviate slightly from the desired creep speed.

Speed regulation on the above lines with the service brake has proved to be very satisfactory also for smaller service hoists working under extremely variable load conditions, despite the fact that the service brake must frequently intervene also during the retardation. In the case of higher speeds and larger loads, however, the energy which has to be absorbed by the brakes, especially during the retardation of a descending load, leads to excessive heating. Should it be desired to employ induction-motor drive also for this type of service, retardation with the service brake must be replaced by electrical braking.

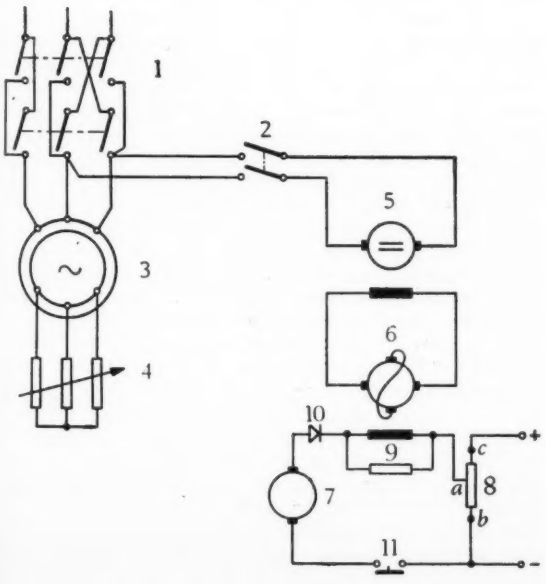
If d.c. braking is adopted, the hoist motor is disconnected from the network and is connected instead to a small d.c. generator. When the hoist motor is energized with d.c., it operates as an a.c. generator and brakes the hoist. The energy resulting from this braking is converted into heat in the secondary resistor of the motor. By designing a suitable regulating system for d.c. braking and combining this with the previously mentioned regulation with the service brake, Asea has succeeded in developing a system with the following features:

(a) Continuous speed regulation right down to creep speed for all loads;

(b) Constant retardation and creep speed irrespective of the load;

(c) Additional safety due to two retardation systems operating independently of one another.

This system is extremely suitable for both manual and pushbutton service, thanks to the above features.



The basic circuit, showing 1, reversing contactor; 2, dynamic-braking contactor; 3, hoist motor; 4, contactor-operated resistor; 5, dynamic-braking generator; 6, metadyne amplifier; 7, tachometer generator; 8, potentiometer for reference voltage; 9, current-limiting device, 10, rectifier; 11, auxiliary contact from dynamic-braking contactor. The hoist is retarded by means of d.c. braking, which implies that the hoist motor 3 is disconnected from the network and connected instead to a small d.c. generator 5. The braking current is regulated with a metadyne amplifier 6, which is fed with the difference voltage between the voltages from a tachometer generator 7 and a reference potentiometer 8. The braking current is consequently regulated automatically in such a way that the winding speed corresponds to the desired speed determined by the position of the reference potentiometer

The Seafield Installation

At Seafield Colliery a two-deck cage balanced by a counterweight, is used for combined men and material hoisting between the surface and two underground levels at 170 fathoms and 300 fathoms. The large cage, while normally carrying one mine car per deck, has sufficient space for carrying extra wide material and can take 50 men per deck.

The mine cars are moved in and out by means of automatic loading arrangements and the decks are changed by means of pushbuttons at the levels. Tilting, pneumatically operated platforms are provided at each level to facilitate the loading and unloading of the mine cars in the cage. The cage runs on four rope guides. Fixed guides, however, are arranged at the top and bottom of the shaft. At the intermediate level, where it is impossible to use fixed guides, a special retaining device has been fitted, this locking the cage into position while it is being loaded. Electrical inter-locking is arranged so that the hoist can only be operated at the creep speed when the retaining device or platforms have been extended. Also at each level before platforms can be lowered or gates

opened, the cage must be proved at the level via switches provided.

Net load	7.5 tons
Weight two mine cars	3.0 tons
Weight cage	12.5 tons
Weight counterweight	19.25 tons
Pulley dia.	10 ft.
Ropes (locked-coil)	No. 4. Dia. 1⅛ in.
Depth of Shaft	1,850 feet
Hoist-motor data	900 h.p., 750 r/m 6.6 kV
Hoisting speed	30 ft/sec.

The pulley is provided with elmwood lagging having turned grooves for the four ropes.

Principle and Design of the System

In the basic circuit when the hoist is being braked, the induction motor is disconnected from the network via the reversing contactor 1, and two of its phases are connected up instead to the d.c. generator 5 as a result of the braking contactor 2 picking up. The field winding of the d.c. generator is connected to the metadyne amplifier 6, the field winding of which is fed, in its turn, with the difference voltage between the voltages from a tachometer generator 7 driven by the hoist motor and a reference potentiometer 8. The voltage of the tachometer generator represents the actual speed of the hoist, and the voltage across terminals *a* and *b* of the potentiometer the desired speed. If the tachometer-generator voltage is higher than that of the reference potentiometer, the metadyne will supply field current to the d.c. generator which, in its turn, feeds the stator winding of the induction motor. The hoist is then braked until the voltages of the tachometer generator and potentiometer are roughly the same. Due to this arrangement, the d.c. excitation of the induction motor is automatically regulated so that the motor produces the braking torque required for the speed to correspond to the desired value given by the reference potentiometer.

The braking torque developed by the induction motor at a certain excitation current will be dependent on both the speed of the motor and the size of the secondary resistance connected to the slip-rings.

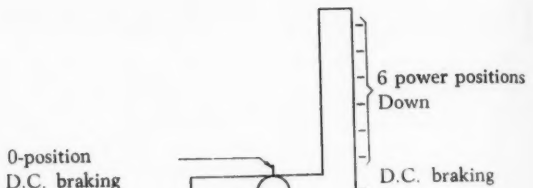
The service brake is utilized for regulating the creep speed for an ascending load. The brakes are pneumatically operated, and the pressure in the service brake is regulated via a sensitive electro-pneumatic regulator.

This senses the difference voltage between the voltages from yet another tachometer generator, driven by the hoist, and a separate reference potentiometer in basically the same way as described for the electrical braking system. If the tachometer generator voltage is higher than that of the reference potentiometer, that is to say the speed of the hoist is higher than the desired speed, the electro-pneumatic regulator will increase the pressure to the service brake, which then reduces the speed to the desired value.

Operation

The Seafield installation is designed for both manual and pushbutton operation. The latter operating system is used for all transport of material, whereas service hoisting is controlled by a winding engineman owing to the present British Mine Safety Regulations in force. The change over from manual to pushbutton operation is made with a change over switch on the control desk.

In manual operation the mine hoist is remotely operated from the control desk set up on the ground level, the movements being controlled with the aid of a controller lever



The slot for the controller lever

and a braking lever. The controller lever moves in a slot. It is moved out of the 0-position by making a short movement to the left or right, depending on the winding direction desired. The d.c. braking contactor, which connects up the hoist motor to the d.c. generator, is energized when the lever is moved to either side position. As soon as the controller lever is moved out into either of the parallel slots, the d.c. braking contactor is disconnected and the hoist motor is connected to the network via one of the reversing contactors. The controller has six power positions in each direction. When the lever is in the first position, the entire secondary resistor is connected up to the rotor circuit of the hoist motor. In positions 2 to 5 the first four contactors are successively closed. In the 6th position the secondary resistor is short-circuited by the remaining secondary contactors via current-limiting relays. If the controller is moved suddenly, the currrent-limiting relays determine also the rate of connection for the first four contactors in order to prevent the hoist motor from being subjected to large current surges.

The braking lever operates the two reference potentiometers mentioned previously for the electrical and mechanical braking. As has already been described, the two regulating systems are designed so that a certain reference voltage corresponds to a certain speed. This means that a certain position on the braking lever corresponds to a determined speed which cannot be exceeded. When the controller is in a power position, the regulating system for the service brake sees to it that the speed of the conveyance in the shaft corresponds to the value determined by the position of the braking lever. If, on the other hand, the controller stands in the position for d.c. braking, both regulating systems are connected up. In order to prevent the service brake from taking part unnecessarily in the speed regulation, its regulating system is set for all the positions on the braking lever to a slightly higher speed than that of the electrical braking. Since both regulating systems are connected up for d.c. braking, an added margin of safety is achieved, as the service brake intervenes automatically and takes over the speed regulation should any fault occur on the d.c. braking system.

In pushbutton operation, two pushbuttons are provided at each level, by means of which it is possible to dispatch the cage to either of the other two levels. In addition, two pushbuttons "Slow up" and "Slow down" are provided at each level for use in conjunction with deck changing and levelling the cage.

When the hoist is being operated by pushbuttons the reference potentiometers controlled by the braking lever

are replaced by two other reference potentiometers, which are driven directly from the hoist shaft during the retardation period. In this way, reference voltage, and consequently also the speed of the hoist, will be directly dependent on the position of the cage in the shaft. These reference potentiometers are wound in such a way that a constant retardation is obtained.

When a starting signal is given, the motor is connected to the network via the reversing contactor for the actual direction to be taken by the cage. The contactor-operated secondary resistor is short-circuited in steps at a rate set by the current-limiting relays. The reference voltage for the service brake is set during the acceleration to full speed, thus causing the brakes to be completely disengaged. When the cage passes the point in the shaft where retardation is to commence, a contact in the hoist regulator gives a signal for retardation. The hoist motor is then disconnected from the network and connected instead to the d.c. generator. At the same time, the two reference potentiometers are connected to the hoist shaft via an electro-magnetic coupling. As the cage approaches its destination, the reference voltage drops and the hoist is slowed down to the creep speed by d.c. braking at a constant rate of retardation.

As is the case with manual operation, the regulating system of the service brake is set to a slightly higher speed than that for d.c. braking. Consequently, the service brake will not normally intervene during the retardation but will only supervise the d.c. braking.

Combined D.C. and Mechanical Braking

The experience gained from the mine hoist installation at the Seafield Colliery indicates that service with a three-phase induction motor having combined d.c. and mechanical braking can be successfully adopted even for pushbutton-operated service hoists having relatively high winding speeds and large motor outputs. The range of application for induction-motor service can thus be extended to cover severe operating conditions, which could otherwise only be met by employing d.c. motors with Ward-Leonard control.

Mica in India

THE production of raw mica in India during 1959, based on exports, is estimated at 80,640,000 lbs., compared with 67,200,000 lb. in 1958. Production of manufactured mica was negligible during the year. Micanite, mica refractories and mica powder were produced during 1959 but production statistics are not available. Shipments of Indian micanite in 1959 totalled 17,000 lbs.; domestic production (for export only) is estimated at about 20,000 lbs. annually. Local consumption of mica is negligible, estimated at 10,000 lbs.

The Export Picture

Exports of manufactured mica in 1959 exceeded exports in 1958 by about 80,000 lbs. The United States continued as the country's best customer for crude mica. During 1959, 38 per cent of the block mica, 43 per cent of the splittings, 31 per cent of the scrap, and about 23 per cent of all other categories of Indian mica exports were destined for the United States.

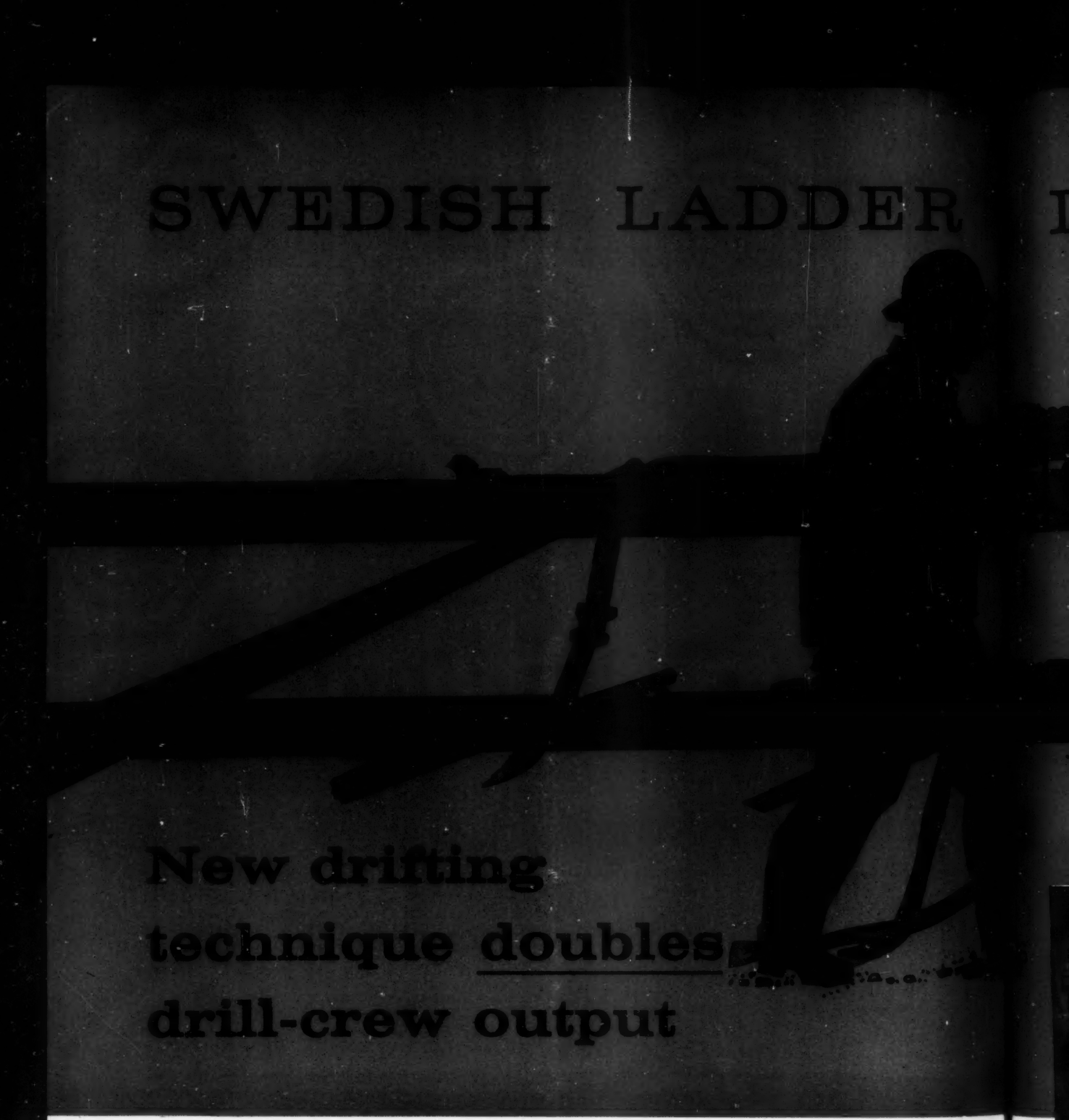
Among the more important traditional consumers of Indian mica, after the United States, are the United Kingdom, Japan, West Germany and France, which together accounted for 40 per cent of the value of all mica exported in 1959. Italy, Belgium and the Netherlands are moderate buyers. There were abnormal increases in exports of mica to the U.S.S.R. and Communist China in 1959. The Soviet *bloc* countries which have, in recent years, begun to provide an increasing outlet for Indian mica, doubled their combined purchases in 1959 and accounted for 19 per cent, by value, of the global trade in mica compared with 10 per cent in 1958.

Contrary to trade beliefs early in 1959 that exclusion of mica splittings from the United States stockpile contracts would have an adverse effect on the Indian mica market, conditions in 1959 were better than in 1958. United States stockpile purchases of block mica under the "D" contract, a strong commercial demand in the United States for cheaper grades of splittings, and an abnormally heavy demand for book form and loose splittings by the U.S.S.R. and Communist China, particularly in the last half of 1959, tended to improve prices and increase the export level.

U.S.S.R. and China entered the Indian market in June 1959 and placed orders for delivery from July to December 1959. U.S.S.R. orders totalled more than 896,000 lbs. and Chinese contracts exceeded 448,000 lbs., all of which were shipped on schedule. The heavy demand from these two countries and a moderate increase in the demands from other countries caused price increase for block, splittings and other types of mica. The price of No. 2 stained block, which was Rs. 24 ($5.04) per lb. f.o.b. Calcutta in January advanced later to Rs. 26 ($5.46). First quality book form splittings No. 5 recorded an increase from Rs. 9 ($1.90) to Rs. 12.25 ($2.57), and dust loose No. 6 from Rs. 1.25 ($0.26) to Rs. 1.50 ($0.32) per lb.

The Mica Export Promotion Council's efforts to promote exports of Indian mica brought no tangible results. It has formed the nucleus of an inspection service to maintain the quality of exports, but mojor exporters reportedly have not taken advantage of the Service. The Council's attempt to form an All-India Mica Miners and Exporters Association has been postponed until the dissenting members present a draft constitution acceptable to all. The Council has suggested to the Government of India that an attempt be made to institute a barter trade in mica with the United States. It is also investigating the possibilities of licensing mica exports to stop shipments on consignment account to the United Kingdom and other European markets.

The Council is negotiating with the American Mica Industries Association in New York to obtain a set of master visual quality samples of mica approved by the American Society for Testing Materials, to work toward standardizing qualities for mica, and to conduct publicity in the United States.



New drifting technique doubles drill-crew output

Controlled feed · guided collaring · mechanical retraction— so one man can operate two rigs

NORTHERN SWEDEN has been the proving ground of a revolutionary rock drilling method which has opened the way to a completely new conception of drill-crew output. Known as the Swedish Ladder Drilling Method, this new technique has been employed on hydro-electric projects at Korsselbränna and Stalon where drilling platforms with 16 rock drills operated by 8-man drill crews have been used.

Atlas Copco drills mounted on retractable pusher legs* are rested in cradles running horizontally in "ladders". Contractors and drill crews have found that these rigs, cheaply and simply constructed, offer the following advantages:

INCREASED PENETRATION—full feed power is ensured by the ideal horizontal feeding position of the pusher leg.

HIGHER OUTPUT PER MAN/HOUR—due to greater penetration and the fact that *one man handles two drills.*

REDUCED CREW FATIGUE—collaring is made simple as operators need not hold the drills. Drill steels are mechanically withdrawn from holes using the retractable pusher leg.

FEWER DRILL STEEL CHANGES—long steels can be used from the start. For greater durability 1″ Sandvik Coromant integral steels are used.

GREATER DRILLING ACCURACY—thanks to the fixed ladder base and pre-positioning of drills for pattern drilling.

DRILLING METHOD

DRAMATIC RESULTS OF LADDER DRILL TESTS

The figures show the dramatic increase in drilling achieved by ladder rigs in a 60 sq.m. tunnel at Stalon driven in hard-drilled quartzite. Gross effect refers to the mean value for the whole drilling period, including collaring, changing steels and the usual routine delays. *Note that the gross effect is exactly doubled.*

GROSS EFFECTS

[redacted]

19.5 metres/man-hour Conventional drilling with *one rock drill*

[redacted]

39.0 metres/man-hour Ladder drilling with *two drills*

AVAILABLE FROM ATLAS COPCO

The Swedish Ladder Drilling Method was originally introduced by Widmark and Platzer, one of Sweden's leading contracting companies, and has been further developed by them and by the Swedish State Power Board. Specially evolved with Atlas Copco trigger-operated retractable pusher legs*, this method and equipment has been exhaustively tested and proved under tough Swedish drilling conditions. There are Atlas Copco companies or agents in ninety countries and details of the new equipment are readily available from them or from the address below. Wherever you are, the international Atlas Copco group offers expert advice on the selection of equipment and a complete after-sales service.

WRITE FOR THE BOOKLET! The Swedish Ladder Drilling Method is described in greater detail in a new Atlas Copco booklet. Write for a copy to your local Atlas Copco company or agent or from the address below.

* Patents pending

Atlas Copco

PUTS COMPRESSED AIR TO WORK FOR THE WORLD

ATLAS COPCO AB, STOCKHOLM 1, SWEDEN

GOLD MINING RESEARCH — I

Research in the South African Gold Mining Industry

This survey—the first of two instalments—is abstracted from the presidential address delivered by W. S. Findlay to the South African Institute of Mining and Metallurgy on August 24, 1960 (J. S.A. Inst. Min. & Met., Aug., 1960)

IN gold mining there are two basic problems : the first is to locate a payable orebody, the second to exploit that orebody to the best advantage not only of the company concerned but also of the nation. In regard to the first problem, there are naturally matters in which research can aid and improve the methods used. Improved instruments for geophysical and geological exploration, better drilling techniques and equipment are the result of determined and thorough research. Research into matters affecting this problem is carried out on quite a large scale in South Africa today, mainly by commercial organizations. Mr. Findlay's address, however, was concerned primarily with the research being conducted into matters affecting the actual exploitation and development of gold mines.

In mining, problems requiring applied research have one feature in common, namely that the circumstances under which the problems occur are rarely reproducible in the laboratory. Hence the only satisfactory laboratory is frequently the mine workings themselves. Basic research, however, finds its real home in the university and research establishments where pure research can be carried on as an end in itself. By the nature of things, the mining engineer is more concerned with applied than with fundamental research and it is not his function to undertake fundamental research except in so far as it may be necessary to solve his particular problem.

The manufacturer is concerned with numerous vital questions such as how to improve the quality of his product, how best to sell it, and how and when to develop and market new products. The gold mining industry is assured of a fixed and stable market and price for its main product and its basic problem, therefore, is to find and recover as effectively as possible from natural occurrences a product of a good quality. There can thus be no comparison between the amount of effort and money expended on research by the gold mining industry and that expended by other branches of industry. Nevertheless it would be found, if such a comparison were possible, that the amount of research conducted in South Africa on behalf of the gold mining industry is proportionately very large.

This research is carried out by a large number of institutions, both private and state-owned or aided. Their work has assisted directly or indirectly in a large number of achievements in the technical field by the gold mining industry in South Africa. South Africa leads the world in the techniques of shaft sinking, tunnelling, ability to mine low grade ores at great depths, and in many aspects of mining. A feature of the research which has contributed to these achievements is that it has been very largely initiated and financed by the gold mining industry itself. In South Africa there is no national mining research institute.

Research by the Chamber of Mines

Research being, in many cases, of common interest to its members, it is not surprising that some, but not all, of it is undertaken by the Chamber of Mines on behalf of members. The mine managements have established study departments whose main functions are to examine and undertake local studies or operational investigations. If the mine is unable to help itself in regard to a particular problem, it has the immediate advantage of being a member of one or other of the large mining groups. These groups provide, *inter alia,* consultative services and they themselves have established research organizations to deal with problems of particular interest to their mines. Most of the metallurgical research in the gold mining industry and also a considerable amount of research into mechanical engineering matters are handled by the groups. There remains a number of vital problems which are of common interest to all the mining companies, such as pneumoconiosis; ventilation problems concerning heat and humidity; control of strata movement; safety in mines and so on. Such matters, by common consent of members, are dealt with through the Chamber itself.

Research on problems applicable to mines as a whole started in a small way and has expanded rapidly, particularly in recent years.

In the earliest days of mining on the Witwatersrand silicosis was a serious problem and the average "mining" life of a European rockbreaker was about three years. The investigation of silicosis was, therefore, one of the first problems tackled in the new mining field. The first formal body established by the Chamber of Mines to deal with the problem—the Standing Committee on Dust Sampling—was established in 1914 with a staff of dust samplers who visited mines. As the work developed and mines became deeper and more extended, it was realised that the study of dust in mine air involved the consideration of general questions of ventilation and that these questions were also significant in the study of the physiological problems arising in unaccustomed conditions of temperature and humidity. In 1931 the entire subject was placed under a newly-established body, known as the "Mine Air Committee", and later as the "Ventilation Problems Sub-Committee". The laboratories of these committees were situated in the head office premises of the Chamber of Mines.

Another problem into which the Chamber conducted research many years ago was that of fungal decay in mine timber. The idea of prolonging the life of timber by a preservative treatment was first suggested in 1916. In 1919 experiments were started at various mines and in 1926 an experimental pressure cylinder for the treatment of timber with preservative solutions was erected. Preliminary research into the actual fungi causing decay in mines was found necessary. This yielded promising results and in 1936 a Timber Research Laboratory was established to continue and expand the work. Research conducted at the Laboratory produced new methods of timber preservation, which have resulted in the life of the treated timber being increased from 2½ to 3 times; while certain materials, such as filter cloths which were formerly liable to perish after 25 shifts, may now last for as long as 325 shifts.

The construction of the present Chamber of Mines Research Laboratory was started in 1949 and the building was

officially opened in 1951. It now houses the Biological and Chemical Research Laboratory—the former Timber Research Laboratory more appropriately renamed—and the Dust and Ventilation Laboratory. The cost of these laboratories, together with ground and equipment, was about £250,000.

In 1950 one of the mining groups, in conjunction with the Council for Scientific and Industrial Research, began the investigation of human physiological problems arising from work in mines. As a result of discussions with several authorities the Chamber of Mines decided to erect a laboratory for the study, on an industry basis, of problems in applied physiology. The erection of the laboratory at Crown Mines was begun in 1954 and the major experimental unit of the Laboratory, the climatic chamber, was commissioned in June, 1956. This Laboratory, known as the Applied Physics Laboratory, cost about £200,000 to establish.

The organization, direction and control of the Chamber's research activities are vested in a Research Advisory Committee, which operates under the direction of, and is responsible to, the Technical Advisory Committee. The latter is a committee of consulting mining engineers to the industry, and ultimately to the Gold Producers' Committee (in whom control of the Chamber is vested).

A series of project and laboratory steering committees is instituted by the Research Advisory Committee, these being generally under the chairmanship of the director of the research laboratory handling the project. A project, once approved in principle, is referred by the Research Advisory Committee to the steering committee concerned for a report and estimate. The work is undertaken by the laboratory concerned and reports and recommendations flow from the director of the laboratory through the steering committee to the Research Advisory Committee and thence to the Technical Advisory Committee and the Gold Producers' Committee and, if approved, are circulated to those mines which are members of the Chamber.

On occasion, the Chamber's laboratories are not suitably equipped to carry out particular work, or it is considered appropriate for work to be carried out by some other organization on the Chamber's behalf. The organization employed in each case is the most knowledgeable, the best equipped and, consequently, the best suited to carry out the work required.

In some cases the work has to be done under operating mining conditions. Assistance is then obtained from individual mines and groups, either with or without the aid of an outside body, the project being carried out on behalf of the industry as a whole.

Financial Support for Research

In addition, the gold mining industry, through the Chamber, provides financial support to research having a general bearing on mining and associated problems. The way in which this is done is illustrated by the following examples:

The *Pneumoconiosis Research Unit* was established in 1955 by the government, under the aegis of the South African Council for Scientific and Industrial Research, to co-ordinate the then existing work and where necessary to institute research projects with a view to the ultimate elimination of pneumoconiosis. Until that time a considerable amount of work in this direction had been undertaken by the mines. One of the objects of the Pneumoconiosis Research unit is to ensure a balanced programme of both engineering and pathological research. The Chamber contributes approximately half the total cost of the unit, which it also assists by undertaking for it a number of research projects in its Dust and Ventilation and Biological and Chemical Research Laboratories.

The South African Institute for Medical Research was founded in 1912, the two contracting parties, the Health Department of the Union Government and the Witwatersrand Native Labour Association, on behalf of the Chamber of Mines, each agreeing to donate a like amount each year. The original purpose was to establish a laboratory for biological research primarily for the investigation of pneumonia, which at that time was responsible for a large proportion of the total mortality among mine Natives. The functions of the Institute have since been enlarged to cover a very wide field. Members of its board are now appointed by the government, the W.N.L.A., the Council of the University of the Witwatersrand, and the South African Council for Scientific and Industrial Research.

The activities of the *Bernard Price Institute for Geophysical Research* are directed to fundamental research on geophysical phenomena. Apart from certain investigations which the Institute has undertaken on a contract at the request of the industry, the Institute receives a substantial donation each year from the mining industry.

From time to time the mining industry has made large donations to the general funds of the *University of the Witwatersrand*. Furthermore, it frequently arranges with various departments of the University to undertake, on its behalf, research on matters connected with mining. Recently the industry made a substantial grant to the Geological Department of the University so that it could establish a Post-Graduate School and Research Unit in Economic Geology.

Apart from donations granted to *Stellenbosch University* for specific objects such as the establishment of an engineering course, the industry has supported financially the Chair of Wood Technology, resulting in important investigations connected with forestry and the growing of suitable timber for mining use. Financial assistance has been afforded to the *University of Cape Town* for basic research into uranium solvent extraction.

Often, in the course of investigations, it appears desirable for the facts involved to be made available to other people interested in the sciences or technicalities concerned. An important way of achieving this object is the encouragement given by the mining industry to the technical societies to organize symposia or to accept for presentation special papers dealing with particular subjects. Many important papers or symposia have been initiated in this manner, among them being the South African Institute of Mining and Metallurgy's symposia on Safety in Mining, Uranium Production, and Shaft Sinking. Encouragement is also given to research workers in the laboratories to publish the results of their work, after they have been made known to member mines. During 1959, the laboratories of the Chamber published 20 papers in various scientific and technical journals.

Recently the industry has undertaken to support a major research programme of the Atomic Energy Board. This programme envisages expenditure on the scale of £800,000 per annum for the first five years and will include investigations on uranium extraction methods and the further processing of uranium oxide to the nuclear fuel stage, on nuclear power in South Africa, on radio-isotopes and radiation. It will also promote fundamental research in fields important to the execution of this programme. The uranium industry, which is part of the gold mining industry, has undertaken to provide £400,000 per annum for the first five years of the programme.

MINING MISCELLANY

Mr. Wilhelm Haglund, president, The Sandvik Steel Works Co. Ltd., of Sandviken, Sweden, left London last week to visit his company's factories in Buenos Aires and Sao Paulo. Mr. Haglund is returning to Sandviken via Lisbon in the early part of November. Readers will recall that the rubber coated steel band conveyors manufactured by Sandvik Steel Works were the subject of editorial mention (pages 387-388) in our issue of October 7, 1960. Sandvik conveyors of this type are installed at Malmberget, Sweden, and our mention described the testing necessary owing to the high working tensions in the bands at this installation. The outcome of these tests decided the design of the Malmberget conveyors.

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The construction of a copper smelter at Las Ventanas, Chile, is to begin in December, according to the *Fortnightly Review* of the Bank of London and South America. The machinery for the plant is expected to arrive in May, 1961.

★

The Central African shaft-sinking record has been set by the Cementation Group's Rhodesian company. At the Mufulira West mine extension, close to the Belgian Congo border, 468 ft. was sunk and lined at the new No. 14 shaft in the last complete month of sinking. Cementation's contract at Mufulira West was completed on schedule. In the course of the contract, the Central African shaft-sinking record was broken four times.

★

Soviet experts who recently visited Cuba at the request of the Cuban Government have recommended the development of offshore oil prospecting, coal mining and metallurgical facilities, according to Moscow Radio. It was further stated that a long-term geological prospecting plan was to be worked out.

★

An expert from Rheinstahl Industrie, of West Germany, has stated that the Farallon Negro manganese deposits in Argentina—exploitation of which is to start by the end of 1962—will be able to deliver 120 tonnes daily to the General Savio steelworks at San Nicolas.

★

The 1,100,000 workers in the U.S. mineral industries set a new work-safety record in 1959, reports the U.S. Bureau of Mines. Fatal injuries including some cases of total disability, declined by 10 per cent from 30 per 100,000,000 man-hours in 1958 to 27 in 1959.

★

It is reported from Bulgaria that this year's output of lead-zinc ore at the mines in the Rhodope mountains will exceed 2,800,000 tonnes. Progress is being made with the construction near Plovdiv of a second large non-ferrous metal combine which will produce annually 30,000 tonnes of zinc, 40,000 tonnes of lead, 60,000 tonnes of sulphuric acid, and considerable amounts of copper, silver, gold and other metals.

A new mechanized berth for loading iron ore was recently inaugurated at Madras harbour by the Indian Minister of State for Transport and Communications, Mr. Raj Bahadur. The Minister stated that India's exports of iron ore were expected to reach 15,000,000 tonnes a year under the Third Plan and it was largely for this reson that the ports of Tuticorin and Mangalore were being developed into major ports. The new berth at Madras, however, is among the major projects of the Second Plan. Costing over £750,000, it can handle up to 1,000,000 tonnes of ore annually.

★

New expansion plans, already approved in principle by the Ministry of Development, include substantial investments in machinery for Timna Copper Works, and also provide for an electrolytic refining plant, additional ore dressing machinery, smelting plant and modern mining equipment. The underground shafts, intended to handle some 1,300,000 tons of ore annually, will be modernized by mechanical excavators at the shaft faces. Ore will be transported by conveyor belts directly to the crushing plants. Israel Mining Industries, who operate the Timna works, intend to double the original I.£26,000,000 investment in this enterprise and to step up production to 14,000 tons of refined copper a year. The new projects are based on a reappraisal of the ore reserves, provisionally estimated at a minimum of 17,000,000 tons.

★

The Study Committee of the West European Coal Producers recently paid a two-day visit to London for discussions with the National Coal Board on matters of common interest, and for a tour of the Board's Mining Research Establishment at Worton Hall, Isleworth.

★

The South African Iron and Steel Corporation (Iscor) is about to start a new expansion programme, extending over 12 years and costing between £270,000,000 and £280,000,000. Iscor's current £56,000,000 expansion programme will be completed within the next 12 months and will raise the corporation's production to about 2,350,000 ingot tons of steel a year. Dr. F. Meyer, chairman of the board of directors, states, however, that by 1964-65 Iscor will have to produce at least 500,000 tons a year more than this amount. Apart from the possibility of exporting Iscor products, South Africa's requirements of the steel products now being manufactured by the corporation will call for between 4,350,000,000 and 4,500,000,000 ingot tons in 1972. This means that Iscor will have to increase its annual steel production by between 2,000,000 and 2,150,000 ingot tons.

★

The Italian company Monte Amiata has received a licence from the Sardinian regional authorities to prospect for bauxite and other aluminiferous ores in the Sassari and Olmedo districts of the island. The local administration has also renewed concessions for a number of other minerals.

A new gold alloy as hard as steel and as easily processed, has been developed in the U.S.S.R., according to a *Tass* report. It is claimed that the alloy—made of gold, copper, manganese, nickel, zinc and cadmium — does not oxidize and keeps its original lustre. Soviet experts hope that it will find a wide application not only in watchmaking and jewellery but also in electronics and radio.

★

We regret to record the death of Mr. G. A. Whitworth, O.B.E., A.C.S.M., lately Principal of the Camborne School of Mines. Mr. Whitworth was also a Member of Council of the Institute of Mining and Metallurgy.

Company News

H.R.H. Prince Harald, the Crown Prince of Norway, is to open a new £2,500,000 sinter plant at Workington Iron and Steel Co. on December 6. The existing sinter plant at Workington, which has been in operation since 1943, has shown the advantages of using sinter and, since additional quantities are now needed, it was decided to build the new plant. Norwegian iron ore is particularly suitable for the acid Bessemer steelmaking process employed at Workington. It is supplied in the form of a concentrate which is finely powdered and therefore demands a sintering technique. The company already uses up to 150,000 tons of these concentrates each year and consumption will be increased to 400,000 tons when the new plant is in operation. This will represent about 60 per cent of their raw materials intake.

★

Fourteen trainee officials from mines of the Anglovaal Group recently left Johannesburg for a fourteen-day study tour in the Northern Transvaal. The tour included visits to the Rustenburg platinum mines, the iron ore mine at Thabazimbi the copper mines at Messina, and the antimony, asbestos and gold mines of the Eastern Transvaal. On the return journey the party visited Albion Colliery and the Premier Diamond Mine. The tour was the final item in a supervision and works study course at the Angovaal Training Centre.

★

The sole agency in the United Kingdom for the range of mining construction equipment built by the Gardner-Denver Co., United States, has now been assumed by the Wickham Mining Division.

★

The directors of The Delta Metal Co., and of Yorkshire Imperial Metals announce that arrangements have been made whereby the alloy tube manufacturing business hitherto carried on by Booth and Mapplebeck, a member of the Delta group, will be acquired by Yorkshire Imperial Metals, and the Delta will take an interest in the latter company. The production of copper tube by the Delta group through its subsidiary, Earle, Bourne and Co. is unaffected by this arrangement.

Machinery and Equipment

Possible Application of Cement Stope Floors

One of the problems involved in any development of fully-mechanized stope cleaning is a sufficiently even footwall. Coupled with this is the question of the recovery of fines, other than by manual sweeping and cleaning operations.

After posing the problem, *The South African Mining and Engineering Journal* suggests that it would appear worthwhile for the Union's mining operators to examine the principle of the tailing-cement stope floors now being used on one of the properties of the Falconbridge Nickel Mines of Canada. In that area a system has been in use until recently of laying and later recovering planks in cut-and-fill stopes to provide a surface for mucking broken ore and a separation between fill and newly-broken ore. Despite its advantages, the process was expensive in terms of labour and there was considerable wastage of material. The next step was the use of standard cement-sand mixtures to form a floor but, with the increasing use of hydraulic fill, a cement mixture has been developed.

Tailings are cycloned on surface to provide the required screen analysis, containing 30 per cent water by weight. Cement is then added to it in 50 ton batch agitator tanks to make mixture of 5 parts tailings to 1 part of cement. About 55 sq. ft. of stope floor 4 in. thick is obtained from one ton of mixture. The material is pumped underground through 3 in. pipes and a diamond drill hole system into the stope. The stope is prepared by laying a bed of plain tailings to within a suitable distance of the face, planks being installed to provide forms from the mixture. The cement-tailings floor is left to cure for four days before the next cut is blasted.

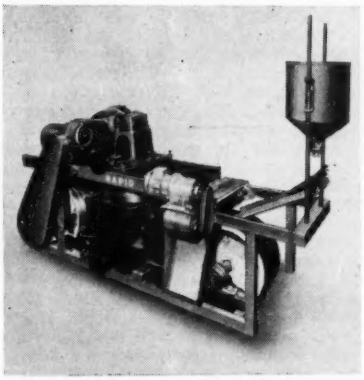
It is stated that the stope can be cleaned with a scraper with no difficulty and the time and cost involved in the recovery of fines reduced appreciably.

RADIOISOTOPE USED TO TAG COAL

Researchers of the U.S. Bureau of Mines are using the radioisotope Gallium 68 to "tag" tiny particles of coal to aid in their studies for finding new and improved uses for coal.

Because of its extremely short life, Gallium 68 is proving ideal for use in experimental equipment for creating synthesis gas from coal. This gas can be treated to yield chemicals, gasoline, and pipeline gas. Gallium 68 has a half-life of only 58 min. and loses its radioactivity in a few hours. Thus, hazards are held to a minimum, no residue remains to contaminate equipment or products of the gasification process, and there is no disposal problem.

The Gallium 68 is made by the Bureau from another isotope, Germanium 68. Prepared by solvent extraction, Gallium 68 is in liquid form. A few drops are dried on to a coal sample and the tagged particle is ready for its journey through the gasifier. Its progress is traced readily from the energetic gamma rays it emits and which carry through heavy pipe walls to detecting devices logging its passage. Bureau scientists at the Morgantown Coal Research Centre have reported that the preparation of the gallium isotope from Germanium 68 and the readying of a tagged sample of coal requires only a few minutes. This makes it possible to introduce the tagged particles on a scheduled basis. The simplicity of preparation and the ease of use enhance the application of Gallium 68 and speed research. The Bureau's present source of Germanium 68 is sufficient for several years' supply of gallium radioisotopes for the coal studies at Morgantown.



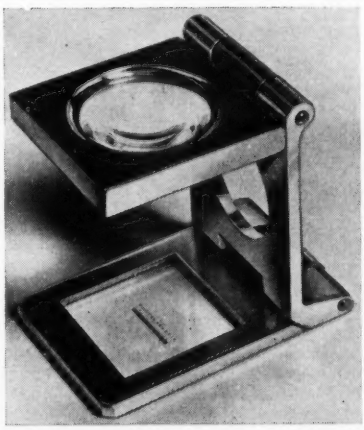
The Rapid Type OG single disc magnetic separator

HIGH INTENSITY SEPARATOR

A new addition to the range of Rapid Magnetic Ltd. is the single disc unit, which treats granular free flowing minerals such as garnet, monazite, ilmenite, wolfram, columbo-tantalite, etc., and incorporates a magnetic scalper prior to the disc which removes highly magnetic minerals such as magnetite, ferro-silicon and other iron oxides so preventing agglomeration at disc discharge. By mechanical adjustment of the disc and rheostatic control of magnet current, a further two magnetic minerals are separately recovered in one passing and discharged either side of separator belt. Clean non-magnetics are discharged at the conveyor head.

Industrial applications include removal of fine iron contamination from abrasives, refractories, chemicals, dehydrated foods, etc., where a completely iron free product is essential. Feed is by gravity from hopper, alternatively a vibratory unit is available. Capacity is dependent on characteristics of the material and degree of separation required.

The pocket graticule and magnifier by Graticules Ltd.



POCKET GRATICULE AND MAGNIFIER

A pocket magnifier with built-in graticule that folds into a square measuring only $2\frac{1}{8}$ in. by $1\frac{7}{16}$ in. by $\frac{7}{16}$ in. has been designed, amongst other requirements, to fill the gap between rough estimation with a scale and precise measurement with elaborate and expensive instruments. The manufacturers are Graticules Ltd.

The micrometer, which is on glass, is mounted in the base of a low powered folding magnifier, the whole frame being made of aluminium, cut away to give maximum visibility, the field of view being 1 in. square. The micrometer scale when used, is placed in close contact with the object to be measured or viewed and the scale shows up well against a wide variety of colours, whilst the graduations are sufficiently fine to ensure a reading accuracy of ± .002 in.

PUMP FOR CORROSIVE LIQUIDS

Hydrofluoric acid is a difficult liquid to handle but in its uranium refining operation, for instance, the United Kingdom Atomic Energy Authority handles ton quantities per day. Improvements in these refining operations have brought many new problems, not the least of which have been those associated with the pumping of this intensely corrosive material.

Now, Capenhurst engineers of the Authority's Development and Engineering Group have devised and tested a rotary pump for operation in hydrofluoric acid. An important feature of the pump, which operates from above the vessel, is its arrangement of a long hollow shaft with bearings self-lubricated by an enclosed oil circuit. The shaft constitutes the oil container and bearing housing, and operation of the pump for long periods of time without maintenance is expected.

The invention has application to other forms of rotary apparatus, such as stirrers, and to other corrosive fluids. The A.E.A. are granting a licence for the manufacture of this pump to Appleton and Howard Ltd.

Metals and Minerals

Price of Gold Takes Wings

On Tuesday, October 18, the price of gold in the London market rose to $35.34 per f.oz. (equivalent to 251s. 6d.) compared with $35.25½ on the previous evening. This was the highest level since the re-opening of the London market in 1954. It was also the first time since 1954 that the price had risen appreciably above the $35.25 theoretical "gold shipment point", at which it pays to buy gold in the U.S. and sell it in the London market.

This, however, was only the beginning. On Wednesday the rise gathered momentum throughout the day. The fixing was on the basis of a middle price of $35.38 per oz., but by the end of the day the price had reached $35.60—a jump of 36 c. since the beginning of the week. The sterling price equivalent, 251s. 8d. at the fixing, was hoisted to 253s. 3d.

On Thursday morning the upward movement became a headlong rush. At the official fixing the dollar price was $36.55 and the sterling equivalent 260s., but prices of up to 269s. were reported in subsequent trading.

The rise was touched off mainly by the brisk demand for gold from private Continental accounts and from a number of European central banks. The basic reason, however, is the combination of a U.S. balance of payments deficit currently running at an overall rate of $2,900,000,000 annually and an outflow of "hot money" due to the disparity betwen interest rates in New York and Western Europe. On Wednesday it was reported that the U.S. authorities were unconcerned, attributing the rise largely to the unsettled international situation, together with the impact of the American election campaign. They profess to see no possibility of the situation getting out of hand. It was also pointed out that so far there had been no indication that a Democratic Administration would be any less determined to defend the existing gold parity of $35 an oz. than the Republican Administration has shown itself in the past two years.

It is apparent, however, that a position such as has now been reached could be held only as long as central banks forebore to convert dollars into gold. At the moment they are holding off. There must surely come a point, however, at which the goodwill aspect is liable to be overshadowed by the commercial aspect. The United States would appear, therefore, to be confronted with the choice of letting the existing situation run, in which case the outflow might well become an avalanche, or to put up the price of gold. Either way, indications seem to point to an increase in the price of gold in the fairly near future, due to the psychological damage which has already been caused to the dollar.

LONDON METAL AND ORE PRICES, OCT. 20, 1960

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £200 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. lb. nom.
Cadmium 10s. 6d. lb.
Cerium (99%) net, £15 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 260s. 0d. (at Thursday's fixing)
Iridium, £20/£23 oz. nom.
Lanthanum (98%/99%) 15s. per gram.
Magnesium, 2s. 2¼d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £600 per ton
Osmium, £18/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £28¼/£28¾
Quicksilver, £70 ex-warehouse
Rhodium, £43/£45 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 46s. 6d. per lb.
Silver, 79¼d. f. oz. spot and 79¼d. f'd.
Tellurium, 28s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis		21s. 6d./22s. 6d. per unit c.i.f.
Beryl (min. 10 per cent BeO)		240s./245s. per l. ton unit BeO
Bismuth		65% 8s. 6d. lb. c.i.f. 18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—		
Rhodesian Metallurgical (semifriable 48%)	(Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
,, Hard Lumpy 45%	(Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
,, Refractory 40%		£11 0s. 0d. per ton c.i.f.
,, Smalls 44%	(Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Baluchistan 48%	(Ratio : 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1) Nb_2O_5 : Ta_2O_5		170s./175s. per l. ton unit c.i.f.
Fluorspar—		
Acid Grade, Flotated Material		£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)		156s. 0d. ex. works
Lithium Ore—		
Petalite min. 3½% Li_2O		50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O		50s. 0d./55s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O		75s./85s. per ton f.o.b. Beira
Magnesite, ground calcined		£28 0s./£30 0s. d/d
Magnesite Raw (ground)		£21 0s./£23 0s. d/d
Manganese Ore Indian—		
Europe (46%-48%) basis 60s. 0d. freight		73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)		69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)		nom.
Molybdenite (85%) basis		8s. 11d. per lb. (f.o.b.)
Titanium Ore—		
Rutile 95/97% TiO_2 (prompt delivery)		£28 0s. 0d. per ton c.i.f. Aust'n
Ilmenite 50/52% TiO_2		£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)		148s. 6d./153s. 6d. per unit c.i.f.
Vanadium—		
Fused oxide 95% V_2O_5		8s./8s. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2		£16/£16 10s. ton c.i.f

NICKEL IN RISING DEMAND

World consumption of nickel this year is expected to be in the region of 250,000 s.tons, compared with 217,500 s.tons last year. This forecast was made in London this week by Mr. Roy Gordon, the recently elected president of International Nickel. With Mr. Gordon was the hon. chairman and former president of Inco, Dr. John Thompson. The company's own contribution to this year's estimated world total will be 175,000 s.tons against 158,500 s.tons last year.

Though consumption in the U.S. this year may not come up to earlier expectations because of the reduced output of stainless steel and other nickel-bearing alloys in the U.S., any easing in this direction has been more than offset by increased sales to Europe.

At the present time Sudbury itself is producing at an annual rate of some 158,500 tons, which is rather on the high side for optimum operating conditions, the ideal maximum rate probably being of the order of 150,000-155,000 tons. The Thompson plant, due to come into operation early next year, has a presently planned capacity of 37,500 s.tons and world demand is rising fast enough to absorb the extra production from this new source.

In addition to what it could produce itself, Inco has been selling this year about 20,000 s.tons of D.P.A. nickel. On the assumption that there are no further sales of D.P.A. nickel next year, Thompson's expected output of 27,500 - 30,000 s.tons in 1961 will more than offset the tonnage made available this year by the U.S. government. World consumption in 1961 is expected to be little changed from the present year, though at least as high, so that it looks as though a small surplus might be available and we understand that, when circumstances permit, it is Inco's intention to build up a stockpile against possible future needs.

Earlier estimates of world supplies have, of course, been affected by the changed situation in Cuba. Nicaro has been operating at about 60-70 per cent of capacity and a probable figure of 20,000-25,000 s.tons has been mentioned for this year, while the anticipated 15,000 s.tons from Freeport Nickel has not materialized. The Russians, however, are expected to be in the world market for nickel on a substantial scale for at any rate the next five years and there can be little doubt as to their readiness to absorb the entire Cuban production for the next decade, even if Freeport were to come on stream again on a new technical basis.

So far as Free World supplies are concerned, there is still an unspecified but substantial quantity of nickel in the D.P.A. inventory. We understand, however, that most of what remains consists of ferro-nickel together with a large quantity of arsenical nickel ore which latter, however, it may prove difficult to sell.

In the event of a squeeze developing in the Free World due to the loss of the Cuban supply, the balance of the D.P.A. stocks would doubtless be made available for consumption. In the background there is, of course, the U.S. national stockpile, which in the present state of high temperature technology the government might well be reluctant to reduce.

Inco's copper deliveries in 1959 amounted to 126,200 s.tons. Since the company's copper output is mainly a by-

product of the nickel operation, the rate of production is not at present controllable, but Mr. Gordon indicated the company's intention to use the lull in copper demand to build up its inventory, as Anglo American is doing. When Thompson becomes fully operational, however, the ratio of copper and indeed of all the other by-product metals to the company's nickel output will be appreciably lower, due to the much smaller proportions of by-product metals contained in the Thompson ore.

QUICKSILVER HIGHER

Quicksilver ex-warehouse London is now indicated at £70 10s. per flask compared with £70. Only two weeks have elapsed since the price was raised from £69 to £70. The persistent upward pressure is ascribed to the disorganization of supplies on the spot, as a result of the continued labour troubles in the London docks. Some supplies of quicksilver have had to be diverted to the Continent. The small parcels previously available have all been taken up, leaving current needs to be satisfied from what metal the main producers still have in stock.

WOLFRAM REMAINS STEADY

The steadier tone which became evident late last week in the London wolfram ore shipment market continues. Dealers now indicate a price range of from 148s. 6d. to 153s. 6d. per l.ton unit c.i.f. Euorpe. The recent sharp fall in prices is reported to have stimulated business. It is understood that Board of Trade material is not being offered at cheap prices.

COLUMBIUM PILOT PLANT

Columbium Mining Products Ltd. is reported to be planning the erection of a 200 t.p.d. pilot plant on its columbium property at Oka, Quebec. The decision to erect this plant is the result of a purchase contract and exclusive sales agency agreement signed between Columbium, W. R. Grace Co., New York, and Metallgesellschaft A. G., West Germany. Columbium Mining is a subsidiary of Headway Red Lake Mines Ltd. and Coulee Lead and Zinc Mines Ltd.

The agreement involves marketing the production of the plant, as well as a mutual effort to establish the product. Annual output would be 700-800 tons of concentrate containing approximately 450,000 lb. of columbium pentoxide. Grace and Metallgesellschaft have agreed to purchase columbium pentoxide up to an aggregate total of 4,000,000 lb., subject to provisions in the agreement relating to marketability and price.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

The weaker undertone mentioned last week has persisted and the metal trade as a whole now appears to have reached that stage when reasons are immediately found to neutralize what would otherwise be "bullish" news.

COPPER EASES FURTHER

The period of adjusting prices to the new level brought about by last week's reduction to 30 c. per lb. by the American primary producers has continued, the customs smelter price being reduced to 30 c. per lb., the Katanga price being reduced to the equivalent of 27.90 c. per lb., New York or Antwerp, and announcements of price reductions having also come from Japan and Australia. All this does not appear to have brought about any marked increase in the volume of business, as with most consumers using a little less metal their requirements outside are met by long-term contracts and therefore all marginal metal is difficult to place.

On the Exchange itself, prices were a little firmer at the beginning of the week but once again tailed off under scattered selling which the "bears" were not prepared to buy without a further drop in price. The contango has remained relatively steady and stocks at the beginning of the week fell by 209 tons to a total of 9,866 tons but the opinion was expressed that this was to be expected after the continuous rise over the previous weeks and the possibility that some metal had not been delivered to warehouse owing to the tally clerks' strike in London.

In Chile the Chuquicamata dispute continues and it is becoming apparent that, with the rejection of what it considered to be a generous offer, the company's attitude has hardened and the dispute may be a long one unless very intense pressure is brought to bear on both parties by the government. This strike is helping to reduce the imbalance between production and consumption and further active steps have been announced from Brussels where it was said that the Katanga production would be reduced by 10 per cent which would mean a figure of 2,500 tons per month. In accordance with the mood at the moment, it was pointed out that this curtailment is almost exactly equal to the expected increase of production in 1960 as opposed to 1959 and that nine months of the increased production had already gone by. The actual figures are an expected total before the cut for 1960 of 308,000 tons as opposed to last year's production of 280,403 tons. Of the other copper companies, International Nickel have announced that they are not contemplating any cut and the same news has been issued by Kennecott. Inco have, however, also indicated that they intend to build-up their copper stocks.

The Copper Institute's figures for September (in s.tons) showed a reverse of the picture for the last few months inasmuch as deliveries were up and stocks were down in the U.S. with the reverse outside. Production of refined copper in the United States amounted to 147,934 tons as compared with the August figure of 157,382 tons. Domestic deliveries totalled 120,585 tons against 105,417 tons and stocks of refined copper at the end of September fell to 84,316 tons from 97,379 tons.

Outside the U.S. production of refined copper amounted to 174,641 tons as compared with 172,983 tons in August. Deliveries fell to 208,075 tons from the August figure of 213,920 tons and end of month stocks rose to 294,529 tons from 285,926 tons at the end of August. It is interesting to note, however, that outside the U.S. the comparison between production and deliveries shows up very favourably when compared with September, 1959, when the production amounted to approximately 143,000 tons with deliveries running at approximately 140,000 tons. Stocks at the end of September of both years have stood at approximately the same figure.

TIN REMAINS FIRM

The tin market continues to maintain a steady undertone with the backwardation continuing, owing to hold-ups in the port of London and although the tally clerks have now returned to work it may be anything up to two weeks before the position becomes normal. Stocks at the beginning of the week showed a fall of 50 tons to a total of 9,045 tons and reports class demand as only moderate although any setback in the price appears to attract additional buyers. Reflecting the commencement of a new quota-free quarter under the Tin Agreement, shipments from Penang during the first half of October amounted to almost 4,000 tons as compared with about 2,850 tons in the corresponding period of September.

On Thursday the Eastern price was equivalent to £800¾ per ton c.i.f. Europe.

LEAD/ZINC MARKETS SLUGGISH

The lead and zinc markets continue their pedestrian way with the latter market showing an easier undertone due to the prominence now being given to the difficulties being experienced by the motor trades in almost all countries in the world. The price structure, however, does not appear to be in serious danger until the strikes at producers in the U.S. are settled, in which case the quotations on that side of the Atlantic for the two metals may have to be lowered and this would undoubtedly affect sentimentally the quotations in London, although to most observers these appear already to have reached a level discounting any foreseeable reduction in the American quotations. As is always the case when a weaker undertone develops, consumers are tending to hold back and general trade in the two metals has not been as satisfactory in the last week as earlier in the month.

Closing prices are as follows:

	October 13 *Buyers*	*Sellers*	October 20 *Buyers*	*Sellers*
COPPER				
Cash	£222¾	£223	£220¼	£220¾
Three months	£224¼	£224½	£222½	£223
Settlement	£223		£220¾	
Week's turnover	11,525 tons		15,225 tons	
LEAD				
Current ½ month	£66½	£66½	£66½	£67
Three months	£68	£68⅛	£68⅛	£68¼
Week's turnover	8,425 tons		7,550 tons	
TIN				
Cash	£808	£809	£808	£808¼
Three months	£798	£799	£799½	£800
Settlement	£809		£808½	
Week's turnover	815 tons		740 tons	
ZINC				
Current ½ month	£88¾	£89	£87½	£87½
Three months	£87½	£87⅝	£85¾	£86½
Week's turnover	5,500 tons		6,275 tons	

Mining Finance

Tin Dividends on the way up

Tin dividends are complicated things. Payments for one year are started before those for the preceding year have been completed. Some years there are five distributions, for others only four and so on. They are thus difficult to tabulate. But the October season with its rising payments is important enough to make it worth while going through the distributions item by item. Those of Tronoh and Gopeng were dealt with last week.

Sungei Besi has announced a bumper return for the September quarter as well as a dividend. Sales of tin concentrates rose to 540¾ tons, which is 168¼ tons more than in the previous three months and makes the total for the first half of the current financial year to next March 913½ tons against only 332¾ tons in the same part of 1959-60. This advance moreover has been achieved during a period when some degree of restriction under the International Tin Agreement has still been operating.

The reason for Sungei Besi's increased output in these circumstances is its acquisition last year of the adjoining Hong Fatt undertaking. This has not only greatly raised the company's opencast production potential, but has also added considerably to its basic assessment under the I.T.A., thus making it possible to step up sales while restriction was still in being. Sungei Besi should in consequence be particularly well placed now that restriction has ended. Its rising output should also be knocking down unit costs.

Meanwhile, Sungei Besi has declared a first interim of 6d. per 4s. share on account of the year to next March and has stated that the second interim will be considered in April with any final in the annual report. This question of a final with the report also applies to 1959-60, the annual report for which is due next month. So far the company has paid four interims for that period totalling 7⅛d., which is modest in relation to the present market price of 22s. 9d. ex dividend even allowing for a final still to come. But these payments are for twelve months during which restriction was still in force and when the benefits of the Hong Fatt merger were not yet being felt. Henceforth there should be considerable increases in the payments.

AYER HITAM'S OUTPUT DOUBTS

Ayer Hitam, another Malayan tin producer regarded as having substantial output potentialities, actually sold less in the September quarter when 637¾ tons of concentrates were disposed of against 703 tons in the June period. But this still means that the company has made a good start to its current financial year which ends on June 30 next because the production for the first quarter (when restriction was still in force) represents an annual rate of 2,551 tons against 1,893 tons for 1959-60. The doubt about this company is whether the big new No. 2 dredge can keep the production up during the period of nine to twelve months while the No. 1 dredge is closed down for modernization. It was due to be shut for this purpose in the current month.

Ayer Hitam's latest dividend is its fourth interim for the year to last June. It is 4½d. per 5s. share and is on the capital as increased by last July's four for one capitalization issue. The three previous interims had totalled 2s. 4½d. equivalent to 5.7d. on the present capital. There should be a final next month. Ayer Hitam stand at 22s. 9d. exactly the same price as Sungei Besi. The latter must definitely look the better proposition of the two in view of Ayer Hitam's handicap of having a dredge shut-down to face.

TANJONG

Tanjong's dividends are now running at a good rate. The latest is the third interim for the calendar year 1960. It is 1s., making 2s. 7½d. to date with, if the normal practice is followed, another interim and then a final to come. It is no wonder that the market is expecting at least 4s. for the year which would be twice the payment for 1959 after allowing for the one for one capitalization issue. The 5s. shares stand at 23s. 9d. and look to be cheap in relation to the potential dividend position.

TIN INVESTMENT COMPANIES

The tin investment companies are naturally reflecting the benefits of the rising payments by the producers. London Tin has raised its interim for the year to next March by 2½ per cent to 7½ per cent on the 4s. shares. For 1959-60 the final was 20 per cent. General Tin Investment is paying 14 per cent on the £1 shares for 1960 against 12 per cent last year. London Tin stand at 12s. 3d. and General Tin at 35s. 9d. Both look to be under rather than over valued.

"JOHNNIES" GOOD START TO 1960-61

In the full Johannesburg Consolidated report for the year to June 30 last it is revealed that of the net depreciation of £603,903 suffered by investments which had a market value of £29,000,000 on June 30, £309,587 arose from a further fall in Freddies Consolidated to 1s. 9d. Their present price is 1s. 10½d. It is stated that diamonds, copper and platinum provided about two-thirds of "Johnnies" 1959-60 investment income.

The report points out that the higher final dividends by the copper companies and the platinum concerns will come into

LONDON MARKET HIGHLIGHTS

Yesterday the Kaffir market was ablaze following the rapid rise in the gold price which reached as high as 269s. on the London market—equivalent to $37.66 (see page 452). The impact of buying from all centres (even London came in as a firm buyer) upon a very thin market resulted in a substantial advance in prices on a wide front. Thursdays prices, in some cases virtually nominal, cannot be usefully quoted.

Earlier in the week the Kaffir market had already staged yet another of its brisk about-turns. To start with, its performance on Monday was rather disappointing as it had been hoped the steadier tendency seen on the previous Friday would develop into a full recovery in the new Stock Exchange account. But after some initial Cape institutional orders had been filled on Monday, Kaffirs drooped back into idleness. Later dealings on Tuesday saw a revival of interest inspired by the demand for gold which culminated in the dollar price here reaching $35.34 an ounce, its best since the London market was re-opened in 1954.

The revival developed into an all-round advance in Kaffirs on Wednesday and was accompanied by a fresh rise in the gold price to $35.60 and a renewed demand for golds on Wall Street. Once again the sharpness of price movements stemmed from a shortage of stock in London; there was little buying power here, the market merely marking up prices to counter a rather embarrassing demand from Johannesburg.

Western Holdings which had been only 136s. 3d. at one time on Tuesday spurted to close at 140s. on Wednesday evening. Free State Geduld were 3s. 9d. up at 132s. 6d. and "Ofsits" rose 3s. to 81s. 3d. St. Helena climbed 2s. to 78s. 6d.; the shares had been previously quite well maintained in an idle market following the September quarterly report which disclosed average gold development values of 770 inch-dwts., the best for a year. Welkom improved afresh to 16s., the move being a continuation of recent Cape demand based on talk of high development values in the mine's rich south-western corner.

The revival spread into the Finance section where Johannesburg demand raised Anglo American 3s. 1½d. to 163s. 9d. Other firm spots here were Gold Fields (67s. 6d.) and Union Corporation (62s. 6d.), each of which gained 1s. 9d.

Inevitably the brighter tendency spread to non-South African golds. Among the Australians, which had already been edging higher on "gold price" buying, Lake View and Star jumped into prominence with an advance of 2s. 6d. to 30s. 9d. and North Kalgurli were 9d. to the good at 10s. 9d. Even the wage-cost troubled Ghana issues managed to harden a few pence occasionally, Ashanti improving to 15s. 3d.

The Base-metal share markets, however, presented a very different picture. Coppers were very much overshadowed by the Rhodesian political troubles and things were not helped by a drooping metal price. But at least the share market was looking steadier by Wednesday evening. Nchanga held at 45s. 6d. after having been depressed to that level by Paris sales and Rhokana hardened a bit to 44s. 9d. xd. Messina, after having sunk to a low for the year together with several other issues, improved to 16s. 6d. on talk of a good final dividend next month.

Tins were also a trifle less unhappy. Previously this market had been particularly dull despite some excellent interim dividends. It was considered that the unresponsive mood was largely connected with over-speculation and consequent embarrassment in the Singapore market.

Lead-zincs, however, remained in the doldrums with prices near their lowest this year as a result of the motor-industry's troubles, Consolidated Zinc having fallen 3s. to 65s. 9d.

the current financial year to next June during which time the income from diamonds looks to be in scant danger while no major change is expected in the revenue from gold-mining investments. So, African politics apart, "Johnnies" prospects seem favourable enough and the substantial yield of over 10 per cent on the £1 shares at 48s. 9d. appears in the circumstances to be generous, especially as even on the most conservative calculation the 5s. dividend is covered something like twice by earnings.

AUSTRALIAN GOLDS IN DEMAND

There has been a sudden rush to buy Australian gold shares in the last day or two by those who think that a few golds in their portfolio would not be a bad idea just in case there is an eventual rise in the price of the metal. Australians appeal to investors who are politically frightened by the situation in Africa where most of the world's gold mines are situated.

One of the shares in demand has been North Kalgurli which has risen to 10s. 9d. ex the final dividend of 6d. making 10½d. for the year to March 29 last. The profit was £168,144 against £161,719, comfortably covering the distribution which takes £144,375. The carry-forward is up from £35,035 to £57,196.

Unlike some Australian gold companies, North Kalgurli does not depend for any part of its earnings on the gold subsidy that has been in existence in that country for some years now. It would thus stand to reap the full benefit of any rise in the gold price. The current yield is 8.1 per cent

WANKIE'S PROFITS HIGHER

Southern Rhodesia's Wankie Colliery continues to pursue its steadily prosperous way despite the threats to its livelihood from the big new hydro-electric source of power at Kariba. For the year to August 31 last the dividend is held at 1s. 3d. per 10s. share for the third successive occasion with a final of 9d. This requires a pay-out of £659,726 from a net profit of £749,060 compared with £632,044. An amount of £335,000 against £285,000 has been placed to general reserve in terms of the government's coal price agreement.

Wankie faces the prospect that from now onwards the demand for its coal is likely to fall off in the face of the competition from Kariba. It is hoped, however, that after three or four years the trend will be reversed by the march of industrial expansion in the Rhodesias. Whether this can be achieved now depends, of course, largely on whether political stability can be reached.

Apart from this, Wankie hopes to be able to get through its "difficult years" while maintaining the dividend by appropriations from accumulated profits and with the assistance of the company's rising investment income. Present price of the shares is 9s. 9d. to yield 12.8 per cent.

BOARD CHANGES

The following appointments have been announced by the Rhodesian Selection Trust Group: Mr. Frank Coolbaugh, who is president of American Metal Climax, Inc., New York, has been appointed to the board of Rhodesian Selection Trust Ltd. in place of Mr. Hans A. Vogelstein, who died last August. He has also been appointed in the place of the late Mr. Vogelstein to the board of Rhodesian Selection Trust Investments Ltd. Mr. Vogelstein was a director and a former president of American Metal Climax Inc.

Mr. E. S. Newson has been appointed to the boards of Roan Antelope Copper Mines Ltd., Mufulira Copper Mines Ltd. and Chibuluma Mines Ltd. in place of Mr. R. H. C. Boys, who has resigned. Mr. Newson is general manager in Africa of the British South Africa Co.

Mr. Boys has also resigned from the boards of Chambishi Mines Ltd., Baluba Mines Ltd., Chisangwa Mines Ltd., Kadola Mines Ltd., Mwinilunga Mines Ltd. and Luapula Mines Ltd. His place on the boards of the Chambishi and Baluba Companies has been taken by Mr. A. L. Austen and on the other boards by Mr. W. C. Krogh. Mr. Austen is resident mining engineer in Africa and Mr. Krogh is local secretary, Northern Rhodesia, of the British South Africa Co.

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Mr. Lionel Harper, a director of Conventry Precision Ltd., has been appointed vice-chairman of the board of Dowty Group Ltd. Mr. Harper is also managing director of Dowty Hydraulic Units Ltd. and a director of Designex (Coventry) Ltd. Mr. E. S. Gibbons, managing director of Designex Ltd., has been appointed to the board of Coventry Precision Ltd.

MINING NEWS FROM LATIN AMERICA

Andacollo Mining's new San Juan mine in Chile is now in production, states the president of the company, Mr. Howard Steven Strouth, a well known mines executive who returned recently to New York from his annual trip to Latin America, and a satisfactory long-term lease has been worked out for the flotation mill at Llay Llay to process the ore. As representative of Cia Minera Advance, Mr Strouth is negotiating forward contracts for iron from the Coquimbo region.

In Peru work continues on the Cerro Landa deposit and the adjoining Huambo claims, on which a large tonnage of copper ore has been developed. A contract has been made for the construction of a sulphur plant in the Piura region to work the Regato deposits under contract to Mr. Strouth and his associates. Work is also being done on the Chimbote magnetite claims held in the name of Standard Magnetite, of which Mr. Strouth is a director. Additional projects in Peru include an operation for gold and silver in the Arequipa region, on which 10,000 ms. of a vein system have been exposed.

As associate and representative of a group which holds the Andes concession in Ecuador, covering more than 1,000,000 acres near the Peruvian border, Mr. Strouth has reported to the group the presence of a number of worthwhile occurrences including gold, copper, mercury, manganese, phosphates, etc. Dr. Paulik, a geologist for the group, has also reported on oil and coal in the same region. A merger with an American public company has just been concluded to facilitate the exploration and exploitation of this vast area. The group is also interested in some gold alluvials and several million acres of oil rights in the Esmeraldas region of Ecuador.

MINING ENGINEER recently qualified A.C.S.M. or equal, with knowledge of geology and surveying required for opencast Mine in Tanganyika. Free passage and housing; home leave on completion of three years Contract. Box 683, *The Mining Journal Ltd.*, 15 Wilson Street, Moorgate, London, E.C.2.

DIAMOND DRILLER required for West African Gold Mines. Salary according to experience, not less than £95 per month. 12 month foreign tours with 3 months' paid leave. Permanent appointment. Pension Scheme. Passages and accommodation provided free for applicant and wife. Write stating age and full particulars of experience to Box 685, *The Mining Journal Ltd.*, 15 Wilson Street, Moorgate, London E.C.2.

METALLURGIST required as assistant to the Reduction Superintendent at a British gold mine in Ghana. Starting salary of not less than £1,500 per annum is envisaged for a suitably qualified man. Tours abroad are for 15 months followed by 3 months' paid leave. Passages and housing provided. The post is healthy and suitable for children. The appointment is permanent and pensionable. Apply with particulars of experience, qualifications and age to Box 684, *The Mining Journal Ltd.*, 15 Wilson Street, Moorgate, London, E.C.2.

GENERAL MANAGER

required by the NIGERIAN COAL CORPORATION for three tours each of 18/24 months.

Consolidated salary according to qualifications and experience in the range £3,000 to £3,500 a year. The officer will be required to join the Staff Provident Fund to which he will contribute 3% of his salary and the Corporation 22%. Outfit allowance £60. Furnished modern house available at £150 a year rent. Free passages for officer and wife. Assistance towards cost of children's passages and grant of up to £150 annually for maintenance in U.K. Liberal leave on full salary.

The General Manager will be required to take control of the Corporation's activities and will be directly responsible to the Chairman. Candidates should be highly qualified Mining Engineers with considerable administrative experience.

Apply to CROWN AGENTS, 4 Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M3C/53238/MF.

Technical Briefs

Improving the Quality of Rock Salt

The use of what has been termed a "sticky surface" is not new, but recently interest has been revived and as a result of investigations carried out by the Battelle Institute at the request of the International Salt Co., a process has been developed for improving the quality of rock salt.

The principal impurities in the rock salt from the company's Detroit Mine are dolomite and anhydrite which represent 2 to 5 per cent of the mined salt. Because rock salt is an inexpensive commodity a low-cost process was required, but it was soon found that established methods did not meet the requirements. Consequently the physical properties of the constituent minerals were examined and the diathermacy of rock salt appears to be a possible basis for investigation.

It was found that the impurities might be selectively heated by radiant heat and possibly the mixed particles could be fed over a belt coated with a heat-sensitive substance so that the warmer impure particles would adhere preferentially to the coating. On this basis, the new process was developed, involving selective heating by means of radiant heat and separation on a coated belt.

In developing such a process many problems were encountered, both in respect of establishing the most suitable heat source and in determining the best type of thermoplastic. The essential requirements for a radiant heat source are that the wavelength be such as to be effectively absorbed by the impurities but not by the rock salt, and that the source be dependable and economical.

As far as rock salt separation is concerned, the material is transparent to energy in wavelengths between 0.3 and 13 microns and the so-called longwave infra red lamp proved silicon carbide and metal sheathed elements since it was found that finely disseminated water on the rock salt absorbed part of the radiant energy from the longer wavelength source. In the case of tungsten filament lamps nearly all the radiation was shorter than 3 microns in wavelength whilst the absorption wavelength of water is largely between 3 to 6 microns. Since heating by conduction must be avoided as far as possible, the feeder plate and surrounding areas were covered with aluminium foil.

In the separation of the selectively heated minerals adequate capacity, adequate retention time and good contact between the particles and the heat sensitive coating, are necessary. Furthermore, it is essential that no more than a single layer of particles be present on the belt. The heat sensitive coating must also have certain properties. It must not be tacky at ambient temperatures, become tacky at a temperature only slightly above ambient temperature, and remain tacky for a considerable range above ambient temperature. In addition, it must be inexpensive. The most satisfactory materials are blends of low molecular weight polymerized styrene resins.

The major problem encountered was in maintaining a uniformly heat sensitive surface for long periods. Owing to dust entering the resin and eventually preventing the particles from adhering it is necessary to renew the resin periodically. The best method appears to be spray coating at least every 20 mins. without interrupting the separation process to ensure that the fresh resin does not affect the adhesion and to apply as thin a layer of resin as possible.

A pilot plant was constructed at the Battelle Institute which could handle 1 ton per hr. and at the Detroit Mine a commercial plant has been operating for almost 3 years at a rate of 30 tons per hr. It would appear that the process could be employed for other separations and experiments indicate that wide differences exist in the degree of absorption by various minerals.

In general the strongly heated minerals include most sulphides and many dark coloured non-sulphides, whilst the transparent as well as the white minerals are relatively affected to a lesser degree, although a great deal depends on the wavelength of the heat source. The choice of heat sensitive resin for a specific application will depend on the temperature of the feed material and the efficiency of the separation required.

ROLLING STEEL WITHOUT MELTING

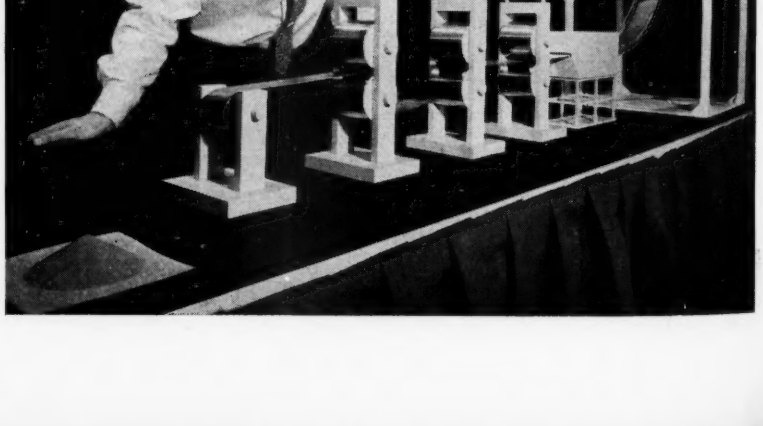
Republic Steel Corporation in the United States has recently developed an entirely new process by means of which it can produce strip steel from iron ore without melting. The process uses iron powder for strip steel rolling and bypasses such conventional production operations as coke ovens, blast furnaces, open hearths and blooming mills. The work on the new process so far has been confined to the laboratory phase. The next stage will be to move to a continuous pilot plant line where larger quantities of materials can be handled.

Republic is the first steel company in the world concerned with the production of strip steel directly from iron ore. The new process of rolling steel from powder will reduce for the company capital equipment and production costs while producing steel equal in quality to steel made by conventional methods.

The process consists of three major steps. First, the iron ore is put through a machine that removes the impurities by magnetically drawing them off the iron. Afterwards, a powerful ball mill grinds the ore into powder and cleans it with hot hydrogen. It is vitally important that the powder should be highly purified as with as little as one half of 1 per cent impurities, the strip steel made from the powder, would tear or crack.

Second, the highly purified metallic iron powder is funnelled between four rolls compressing it into a semi-solid strip by rolling. Finally, the strip passes through a furnace, where it is heated to 2,200 deg. F., so it can be rolled. Then it passes through a series of hot-strip rolling stands where it is squeezed between rollers. The hot rolling step reduces the thickness of the steel

The operating sequence of Republic Steel's new strip steel rolling process in which highly purified iron powder is turned into strip steel without melting. In the process, iron powder is poured into the funnel at upper right and then is compressed between four rolls atop the platform into a semi-solid strip. The strip then is passed through a heating furnace and through a series of hot strip rolling stands. The hot rolling reduces the thickness of the strip to the desired gauge and full density and produces hot rolled steel in coils



strip to the desired gauge and to full density and produces hot rolled steel in coils that have the same quality as conventionally made steels. Then the steel is pickled, cold-rolled and annealed in conventional ways before being recoiled or cut into sheets.

The company produced more than 1,800 lb. of steel by the new process in the laboratory. Tests clearly show that quality steel can be produced by the new method. A number of difficult problems have been overcome in obtaining the results so far and there are many additional obstacles ahead as the company moves into development work on larger dimensional scale. The company is concentrating now on long range plans including a pilot plant operation and an evaluation of the cost of making commercial quantities of steel by the new process. It is certain, however, that iron ore powder has to be abundant, pure and inexpensive and in price has to compete with ingot, before large scale commercial operation can start.

DETERMINATION OF LEAD TRACES

A method for the reliable determination of traces of lead has been developed to overcome the inadequacy of existing dithizone methods for the determination of lead in mafic igneous rocks that contain relatively large amounts of iron, zinc, and certain alkaline earths. In this method interferences from these elements are overcome without using special equipment or time-consuming separation techniques.

Ferric dithizonate has been extracted from alkaline solutions and observed to exhibit a maximum absorbance at 435 millimicrons. This dithizonate of iron has prevented accurate determinations in the laboratory of lead in mafic igneous rocks containing 10 per cent or more iron.

A simple extraction of iron and zinc thiocyanates from an acid solution with ethyl acetate separates the iron and zinc from the lead, eliminating any possible interference from these elements. The precipitation of calcium or magnesium phosphate and of aluminium hydroxide that otherwise would occur at the optimum pH for the dithizone extraction of lead is prevented by using a sample solution that contains 20 per cent ammonium citrate. The method permits the determination of 1 part per 1,000,000 of lead in igneous rocks.

The method is described in *Spectrophotometric Determination of Traces of Lead in Igneous Rocks,* published as U.S. Geological Survey Bulletin. 1084-F.

ION FLOTATION DEVELOPMENT

Ion flotation developed by Professor Felix Sebba of Witwatersrand University, in small scale tests has proved an efficient method of recovering nonferrous metals from mine waters and dilute liquors. In some quarters it was regarded as a possible technique for extracting metals from sea water.

South African Engineering and Mining Journal now reports that patent application has been made in the United States and 31 other countries by Armour and Co.'s Fatty Acid Division covering the process. Although Armours regards the sea water aspect as not being without interest, it intends undertaking research on the mine water applications.

Basically the process is the same as mineral flotation, except that no mineral is involved, only the metal ions in solution. Soap, with an affinity for certain metals or metal groups, is bubbled through the metal-bearing solution where the soap reacts with the metal ions to produce a water-insoluble heavy metal soap which floats to the surface and is skimmed off with other soap bubbles.

Armour hopes to find soaps that will be selective. Two approaches are open. One is to find selective hydrocarbon soap partners. The other is to take advantage of the electromotive series of metals.

COUNTERFLOW SIZER BENEFITS SPIRALS

Hindered settling is now being employed for removing large particles of heavy minerals from the rougher concentrate derived from Humphreys spirals before cleaning, states J. V. Thompson (*Eng. Min. Jnl.*, July, 1960).

Whilst there is nothing new in this practice, since it is a well known fact that large high specific gravity particles segregate with smaller particles of waste, and hydraulic classifying pockets have been used to separate such material produced by tables, the counterflow sizer is simple in design and consists of two conical chambers mounted one above the other. The feed enters the upper cone tangentially as in a cyclone and the overflow is removed by a central opening similar to the conventional vortex finder. The apex of this cone terminates in a large diameter sorting column, which is enclosed in the lower cone and into which the classifying water is introduced tangentially and in a direction opposite to that of the feed.

FLOCCULATION IN COAL SLURRY FILTRATION

Traditionally, fine coal is more troublesome than the coarser sizes at every step of the coal preparation process—screening, cleaning, dewatering, and drying. Therefore the present trend toward a higher proportion of fines in the run-of-mine product, brought about by changes in mining practice necessitated to increase productivity, has added greatly to the task of preparing coal for the market. One of the more difficult and costly problems involved is that of recovering fine solids from the washery water. These fine solids should be recovered in the interest of conservation, and they must be removed to provide recirculating water of proper quality. If there is a plant effluent, it must meet increasingly stringent requirements against stream pollution. These problems are considered in U.S. Bureau of Mines *Report of Investigations* 5535.

Vacuum filtration has been used for years at a few plants to recover the extreme fines, but its additional cost discouraged general adoption until recently. Now, with growing emphasis on better solids recovery, filtration is becoming more widespread. Many coal slurries filter readily, giving high cake rates and clean filtrates. Others, however, particularly those containing either a high proportion of material finer than 200-mesh or an appreciable amount of clay, are much more difficult to filter. Many of these refractory slurries can be rendered more filterable by flocculation.

Lime and starch (the latter either plain or causticized) have been used as flocculants by the coal industry for years to increase the settling rate of coal slurry and thus improve the capacity of thickeners. These flocculants are now being used to improve the filtration characteristics of some slurries. Recently, a host of new flocculants has been made available. They are primarily synthetic polymers or gums, and with some of them very small quantities are extremely effective.

The threefold obective of the investigation was to determine: (1) How the newer flocculants compared with lime and starch in improving filterability, (2) to what extent slurries of different composition could be improved through flocculation, and (3) why some slurries are much more difficult to filter than others. The scope of the investigation embraced 3 natural slurries, 3 synthetic slurries or suspensions, and 16 flocculants. A standard test-leaf filter was the principal tool used to evaluate filterability, but confirming tests were made with a laboratory-size disc filter.

The individual flocculants exhibited a wide range in effectiveness; and, although some of them were consistently superior with all slurries tested, no one flocculant was universally the best. Some of the newer flocculants were so effective that only a few thousandths of a lb. per ton of solids was needed, but in most instances their performance did not exceed that possible with larger amounts of starch.

NEW IRON ORE REDUCTION PROCESS

A new reduction process for iron ore, known as the CO-C process, has been developed at Hamburg University in collaboration with the German ferrous metals concern Phönix-Rheinrohr AG,, of Dusseldorf. The process is based on the use of a gas with a high carbon monoxide content, in which the ratio carbon monoxide to hydrogen is that of four or more to one. It is divided into two main phases—the pre-reduction of the ore and the withdrawal of the carbon from the gas, followed by the final reduction of the ore, at higher temperatures and using the isolated carbon. The product of the first primary-reduction stage is in the form of granules, each containing iron, wüstite and magnesite and coated with a carbon layer. The carbon monoxide, which is passed via sulphur-cleaning into a fluidized bed before use, waste gas being put back into circulation via a carbon dioxide wash, is consumed at the rate of 1,200 cu. metres per tonne of iron.

Final reduction of the ore needs nothing like the heat required for blast furnace operations, the isolated carbon produced from the carbon monoxide gas being far more reaction-efficient than furnace coke. In addition to this, a large proportion of the ferrous oxide is reduced in the final stage in a relatively short time by direct conversion with solid carbon. End processing to spongy iron powder is effected by simple heating to 900 deg. C., oxygen escaping as carbon monoxide plus small quantities of carbon dioxide.

MOUNT ISA MINES LTD.

The annual general meeting of Mount Isa Mines, Ltd., will be held on November 8 in Brisbane, Queensland.

The following is an extract from the Statement of the Chairman, **Mr. G. R. Fisher,** circulated with the Report and Accounts for the year ended June 30, 1960:—

The year's operations were highly satisfactory, although the marked variations in metal prices and the increase in costs of labour and supplies caused some concern.

At the commencement of the financial year, the price of copper was £A278 per ton, rising in February, 1960 to £A346, a variation of £A68 or 24.5%. At the close of the year the price had fallen to £A321. Throughout, the weekly average price varied up to £A20 per ton, with many other sharp weekly rises and falls. The average price received for copper at £A307.08 was greater than that received for the metal in 1959 year, namely £A295.54.

Lead prices also varied considerably, opening at £A87.2 per ton, rising during May, 1960, to £A98.1 and falling to £A89.4 at the close of the year. The average price received for this metal at £A93.79 was higher than £A91.87 received last year.

Zinc prices also fluctuated considerably, opening at £A100.3 per ton, rising to £A122.2 during October, 1959, and falling to £A113.2 at the close of the year. The average price received was £A109.55 compared with £A86.69 received for 1959 sales. The tonnage of this product sold fell short of the 1959 sales by 2,991 tons. Further sales could not be arranged due to the lack of railway facilities which were fully taxed.

There was a small upward movement in the price of silver, the average price for 1960 year being 8.27/- (Aust.) per ounce compared with 8.03/- (Aust.) for 1959.

After providing £A1,550,733 for depreciation of plant, machinery, buildings and community assets; £A273,345 for mineral royalty; £A1,355,361 for income tax and £A1,336,161 for income tax equalization, the consolidated nett income was £A5,358,239 compared with £A4,026,855 for the financial year ended June 30, 1959. This result will permit your Company to continue with its policy of financing from earnings the Expansion Programme at Mount Isa and at the Copper Refinery at Townsville.

The improved financial outcome is due chiefly to the improved metal prices received and the increased production which resulted from the introduction of additional new ore handling plant underground and increased milling capacity. Although there was some improvement in the price of lead, the world lead statistical position, due to oversupply did not materially improve, and it was agreed to curtail production of this metal.

Cash dividends totalling 1/3d. (Aust.) per stock unit of 5/- (Aust.) were paid to Stockholders during the year, comprising a final cash dividend of 9d. (Aust.) per stock unit totalling £A1,068,701 paid on December 31, 1959, from last year's earnings and an interim dividend of 6d. (Aust.) per stock unit requiring £A712,467 declared in the year under review and paid on June 29, 1960, from this year's earnings.

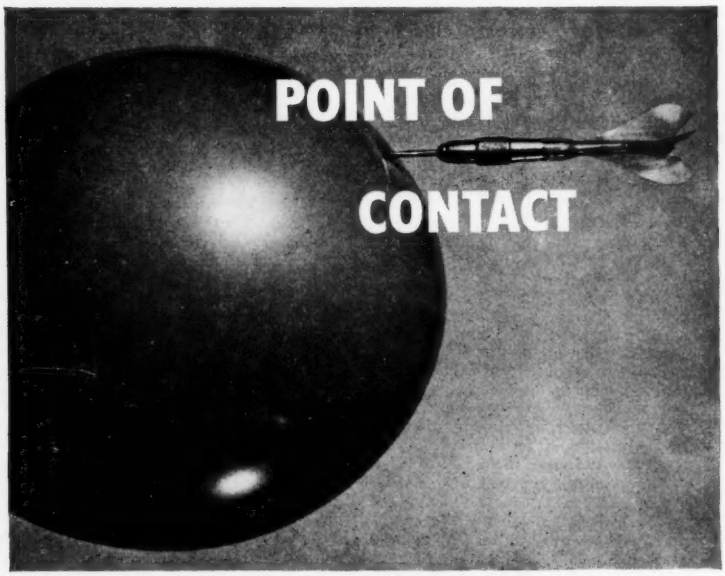
Cash dividend payments for each of the past two years have exceeded any previous years, despite the heavy capital expenditure and disturbing cost increases outside the Company's control. Your Directors consider that a conservative policy is still to be maintained, so that the retained earnings may be utilized to continue with the expansion plans, which have been fully explained in this and previous reports.

High Level of Production

Production was maintained at a high level, and the total of 2,687,586 tons of ores treated is a record for the Company, being 18 per cent higher than the previous record of 2,278,579 tons established last year.

Exploration and development work were continued at a substantial rate. Apart from providing ore to satisfy the planned production programme, this phase of the operation also resulted in increased ore reserves, and gives added assurance to the Stockholders that the mine will have a long life at the proposed increased production rates.

Despite the curtailment of capital expenditure brought into effect during January, 1960, considerable progress was made and the commissioning of the new copper smelter now scheduled for 1961 will complete the first stage of the Expansion Programme. Following the announcement that the rehabilitation of the Townsville-Mount Isa railway had been financed, the second stage expansion plan to treat 14,400 tons ore per day was placed in hand. Major projects involved are the new K 57 shaft, a new 5,400 tons per day mill, and extensions to the Mica Creek power house and smelters.



An electronic flash picture, using the new microphone technique photographed by H. Davis and Tom Carlton

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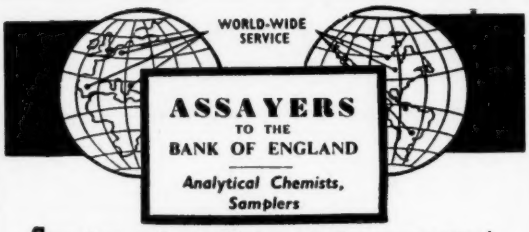

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